A
COLLECTION
OF
PAPERS
ON
AVAL ARCHITECTURE

IGINALLY COMMUNICATED THROUGH THE CHANNEL
OF THE

EUROPEAN MAGAZINE,

WHICH PUBLICATION THE FURTHER COMMUNICATIONS ON THIS
SUBJECT WILL BE CONTINUED.

TO WHICH ARE PREFIXED,

. The ELEVENTH REPORT of the
MMISSIONERS appointed to enquire
the STATE and CONDITION of
WOODS, FORESTS, and LAND
VENUES of the CROWN, and ſell or
nate FEE-FARM and other unim-
vable RENTS. Dated February 6,
2.
I. EXTRACTS from APPENDIX to the ſame; conſiſting of various intereſting PAPERS on SUBJECTS of NAVAL ARCHITECTURE; PRICES of TIMBER, &c. &c.

III. Two ESSAYS relating to SHIPPING. By SIR WALTER RALEIGH, Knt. 1. On the firſt INVENTION of SHIPPING. 2. On the ROYAL NAVY or SEA SERVICE.

PART III.

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PREFACE.

TO this THIRD COLLECTION of the Communications of various CORRESPONDENTS, to whom we here return our grateful thanks, we have prefixed two ſcarce Tracts relating to Shipping, written by SIR WALTER RALEIGH, which are ſeldom to be met with; and OAK TIMBER becoming a matter of national importance, we have reprinted the valuable REPORT made by the COMMISSIONERS of PUBLIC ACCOUNTS to the HOUSE of COMMONS on that Subject, in FEBRUARY 1792, *verbatim*; and annexed ſuch Papers of the APPENDIX as appeared to us to be the *moſt intereſting* to our Readers.

THE uſual part of the Blue Cover of our Magazine will be reſerved for Papers on the Subject of Naval Architecture; but we wiſh our Correſpondents would confine their obſervations and enquiries more to the conſtruction of the Hull, being convinced that our Officers and Men are equal if not ſuperior to any foreigners in moſt other parts.

ERRATA.

Page 6. l. 1. for *poſſeſſion* r. *poſſeſſions.*
9. from bottom, for 2*s.* r. $20\frac{1}{6}$. See APPENDIX, No. 1.
8. l. 23. for *of timber* r. *of the timber.*
18. l. 2. for *at preſent are*, r. *are at preſent.*
l. 3. for *rights*, r. *right.*
125. l. 7. after BOREALIAN, add the following Note: "See page xx. of "the SUPPLEMENT to Part II. of this COLLECTION."

THE

ELEVENTH REPORT

OF THE

COMMISSIONERS

APPOINTED TO ENQUIRE INTO THE

STATE AND CONDITION

OF THE

OODS, FORESTS, AND LAND REVENUES

OF THE

CROWN,

AND TO SELL OR ALIENATE

E-FARM AND OTHER UNIMPROVEABLE RENTS.

DATED FEBRUARY 6, 1792.

ORDERED TO BE PRINTED FEBRUARY 13, 1792.

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THE

ELEVENTH REPORT, &c.

To the Honourable the Knights, Citizens, and Burgeſſes, in Parliament aſſembled.

IN the Reports which we have preſented to his Majeſty, and to both Houſes of Parliament on the ſtate and condition of the Royal Foreſts, we have ſhewn, that while the eſtates of individuals in every part of this kingdom have been advancing in improvement, the property of the Crown in thoſe foreſts has been left unprotected, and expoſed to unlimited waſte.

The public intereſt certainly requires that ſo extenſive and ſo valuable a part of the landed property of the country ſhould not be ſuffered longer to continue in its preſent unproductive ſtate; and that either the plan of management which has been purſued ever ſince the beginning of the preſent century, and which has had ſuch deſtructive effects, ſhould be completely altered, and new regulations eſtabliſhed which may render thoſe foreſts uſeful nurſeries of timber for the navy; or that they ſhould be ſold and converted to tillage or paſture, ſo as to add to the produce and population of the kingdom.

To avoid the danger of forming an opinion on a partial view of the ſubject, and to enable us with confidence to recommend to the Legiſlature that meaſure which would be moſt expedient for the public, it ſeemed neceſſary that our inquiries ſhould not be confined to the Royal Foreſts only, but that we ſhould endeavour alſo to obtain the beſt information concerning the preſent ſtate of the timber growing on private property in this country, with a view to aſcertain, whether there has hitherto been a decreaſe in the quantity, and whether there is ſuch a ſtock now remaining and ſuch a proſpect of a ſucceſſion, as that Government may ſafely depend on having a full ſupply in future for the Navy, without any reliance on importation from other countries, and without undertaking the improvement of the Royal Foreſts as nurſeries of timber.

On the reſult of this enquiry muſt ultimately depend the determination of the queſtion, Whether there is, or is not, a neceſſity for undertaking that improvement?

If the increaſed demand for naval timber ſhould be found to have given ſuch encouragement to the planting of oak, and to have created ſuch an additional ſupply on the eſtates of individuals, as to enſure a ſufficient and permanent proviſion for the navy; the queſtion would then only be, Which of theſe plans would be the moſt eligible in point of *profit*—that of keeping the foreſts as nurſeries for the growth of timber; or the alternative of ſelling them, and inveſting their produce in the funds? But if, on the other hand, it ſhould be found, that an increaſed demand has not the ſame effect in creating a ſupply of timber, as of other articles capable of being increaſed by the means of induſtry; and that though the demand is increaſing, there has been a gradual decline in the quantity produced, if no permanent ſupply can be relied on from private property; and if it is unſafe, and unwiſe, to ſuffer this country to become dependant on foreign powers for what is eſſential to its own defence, the better management and improvement of the Royal Foreſts, as nurſeries of timber, becomes a meaſure, not of choice, but of neceſſity; a matter, in which the ſafety of the country is concerned, and to which it is the duty of Government to attend.

We had not advanced far in this inquiry before we ſaw reaſon to believe that a decreaſe in the quantity of timber was by no means confined to the Royal Foreſts; but that the general ſtock of large timber growing on private property was alſo, from various cauſes, leſſening rapidly; and that the apprehenſions of an approaching ſcarcity were but too well founded. Under the impreſſion of this danger, we deemed it our duty to recommend, that all thoſe foreſts in which the Crown has reſerved any very conſiderable ſhare of the property, or which are ſituated near to any of his Majeſty's dock-yards ſhould be retained, and to ſuggeſt ſuch plans of future management and improvement, as appeared to us beſt adapted to the peculiar circumſtances of each, and likely to procure the largeſt ſupply of timber at the leaſt expence or riſk to the public; not thinking that any advantage which could be derived from the ſale or cultivation of the land was worthy of conſideration, when compared with that great national object.

But though the information we had received of a general decreaſe of great timber in this country was ſufficient to convince us of the expediency of keeping thoſe foreſts in the poſſeſſion of the Crown, we thought it right to continue our inquiries on that ſubject; and, wiſhing to guard againſt the hazard of exciting an unneceſſary alarm in a matter of ſo much conſequence, we reſolved to poſtpone any Report on the general ſtate of the timber until our information ſhould be ſo complete, as, in our opinion, to remove any doubt which might be entertained on the ſubject.

Having finiſhed our inquiries concerning this branch of our duty, we now propoſe to lay the reſult of them before the Legiſlature; and as this Report will, unavoidably, be of conſiderable length, and will embrace a variety of objects diſtinct in themſelves, though connected with the general ſubject, we ſhall, for the greater perſpicuity, divide the ſubſtance of it into Five Parts.

First, In the Firſt Part we ſhall give the information we have collected relative to the ſtate of timber in this country in former times, as well as at preſent, marking its gradual decline, and ſuggeſting what appear to us to be the cauſes of a decreaſe in the quantity, notwithſtanding an increaſed demand.

Secondly, We ſhall give a very brief account of the laws now in being concerning timber on private property, as well as of thoſe relating to foreſts; with ſome obſervations on the tendency and effect of thoſe laws.

THIRDLY, We ſhall give the beſt account we are able of the conſumption of oak timber in this country, particularly for naval purpoſes.

FOURTHLY, We ſhall endeavour to ſhew what ſupply may be expected for the navy, from the Royal Foreſts in future; and what profit may ariſe to the public, if proper plans ſhall be adopted for their improvement.

And FIFTHLY, We propoſe to point out ſuch means of preventing waſte in the conſumption of naval timber, and providing ſuch ſubſtitutes in caſe of a ſcarcity of oak, as appear to us deſerving the attention of Government.

PART I.

Of the State of Timber in this Country in former Times, and at preſent.

IN this inveſtigation it is to be lamented that no general ſurvey was ever made of the whole of the timber growing in England at any one time; as ſuch a ſurvey, compared with our preſent information, might have led to almoſt certain concluſions with reſpect to the ſuppoſed decreaſe.

The evidence of the ſtate of the timber in former times muſt be drawn from different authorities, and from a number of detached circumſtances, concurring to ſhew the various degrees of plenty at different periods in proportion to the demand.

Not wiſhing to ſwell this Report with numerous extracts, we propoſe only to refer very briefly to ſuch authorities as may be neceſſary to ſhew the effect of the progreſs of agriculture and population upon the ſtate of the timber in this country, from which a judgment may the more eaſily be formed of the truth of the opinion we ſhall give.

This country, like every other country capable of producing trees, is deſcribed, in the earlieſt accounts of it, to have been covered with wood; and even in the reign of William the Conqueror, when conſiderable advancement had been made in cultivation, the woods were ſtill ſo numerous and extenſive, as to be valued, not by the quantity of the timber or of what could be annually felled, but by the number of ſwine which the acorns could maintain *.

An eminent writer on this ſubject, ſpeaking of the ſtate of the woods and timber in this country in the time of Edward the Fourth, near 400 years after the compiling of Domeſday, ſays, "England was then an overgrown country;" and the well-informed editor of the works of Evelyn obſerves, that "the firſt attack of any conſequence made upon "our trees" was in the 27th of Henry the Eighth, when that King ſeized the poſſeſſion of the monaſteries, and converted them to his own uſe, diſpoſing of all the timber.

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* Domeſday Book, Vol. 1. fol. 2, & 3. *et paſſim.*

That meaſure was followed by a continued, and we believe an uninterrupted increaſe of conſumption of oak timber, not only in conſequence of the gradual extenſion of commerce, and of additions to the Royal Navy, but of more being alſo made uſe of in houſe-building during the 16th and 17th centuries than in earlier times.

Holingſhed, who lived in the reign of Queen Elizabeth, ſays, in his deſcription of Britain, that "in times paſt men were contented to dwell " in houſes builded of ſallow, willow, &c. ſo that the uſe of oak was in " a manner dedicated wholly unto churches, religious houſes, princes " palaces, navigation, &c.; but now ſallow, &c. are rejected, and nothing but oak is anywhere regarded."

The quantity of timber having alſo been conſiderably diminiſhed, the price advanced; and during the laſt mentioned reign, the timber in the Royal Foreſts became a ſource of ſome revenue to the Crown.

In the time of James the Firſt this fund increaſed; and, becoming more an object of attention, many plans were ſuggeſted for rendering the foreſts ſtill more productive.

In 1608 that King, being deſirous to raiſe money by a ſale of timber, directed a ſurvey to be made of all that was then fit for felling in the Royal Foreſts, and other eſtates of the Crown, in order to diſcover what quantities might be ſpared, leaving a ſufficient ſtock for the ſupply of the Royal Navy. Thoſe ſurveys, which are ſtill preſerved in a Collection of Papers left by Sir Julius Cæſar, Chancellor of the Exchequer to that King, and which were purchaſed by John Pitt, Eſq. late Surveyor General, and lent to us by William Morton Pitt, Eſq. were taken by ſurveyors of the firſt character, recommended by and acting under the controul of perſons of high rank, Members of the Privy Council, to whom the ſuperintendance of this work in different diſtricts of the kingdom was committed; and thoſe ſurveys are the firſt written documents of which we think it neceſſary to take particular notice.

Various memorandums in the ſame Collection ſhew, however, that the whole was not completed. Neither the large and valuable Foreſt of Dean nor that of Whichwood were compriſed in thoſe ſurveys; nor did they include the timber on any eſtate where the quantity did not exceed what was deemed neceſſary for the purpoſes of ſuch eſtate. In many of them the number of loads of timber is not particularly mentioned; but that defect we are enabled in ſome degree to ſupply, from the total value of the timber being given in every ſurvey, and the current price in ſome of them, which appears to have been about 10s. per load for oak; except in ſome parts of the country near London, where the demand for building-timber and firewood rendered it ſomewhat more valuable. Eſtimating the timber at that rate, and the firewood at 2s. per load, which appears to have been the average prices, there muſt have been then growing on the part of the Crown's eſtate that was ſurveyed about 649,880 loads of oak timber fit for the Navy, and 1,148,660 loads of what was dotard and decayed (*Vide* APPENDIX, No. 1.).

Theſe ſurveys furniſh the moſt authentic and convincing information, both as to the effect of the management under which the Royal Foreſts were then kept, and as to the general plenty of timber in the kingdom in proportion to the demand for it.

The great ſtore of timber is in ſome degree a proof of the care which had been taken of the Foreſts ; and under ſuch management the great number of trees allowed to ſtand till they had become dotard and decayed, and fit only for fuel, cannot be accounted for in any other way, than from the quantity then growing being far greater than the uſes of the country could conſume. It was the practice in thoſe times, annually to make ſales of wood and timber for the benefit of the Crown ; and Queen Elizabeth was too good an economiſt, and her ſucceſſor too needy, to have allowed any great quantity fit for felling to remain unſold, if there had been a demand for it. We find alſo from other documents, that a great part of what was intended to be ſold in 1608 remained for a conſiderable time undiſpoſed of.

The current prices mentioned in ſome of the ſurveys furniſh another unqueſtionable proof of the great plenty of timber at that time, when compared with the preſent. The rate of 10s. a load for oak fit for the Navy, which is not more than one-eighth part of the preſent average price of ſuch timber *, appears not to have been any temporary depreſſed value in conſequence of that extenſive ſale, but to have continued pretty nearly the current price of timber for a number of years after. In 1638, Charles the Firſt ſold to Sir John Wintour the timber growing in Dean Foreſt, reſerving to himſelf 15,000 tons for the Navy under this condition : “ that what was ſhort of that proportion ſhould be made “ good by the grantee at 9s. per ton, or the King to take more *at that* “ *rate*.” And in a Report of a Committee of the Houſe of Commons in 1664 concerning that grant, the timber *in general* is eſtimated at 13s. 4d. only, and that which was fit for the navy, taken by itſelf, at 15s. per ton.

We have endeavoured to trace the periods at which the great increaſe in the price of timber, and the diminution in the quantity ſince the reign of Charles the Firſt, took place ; and we find that the firſt great advance in the price happened ſoon after the Reſtoration. This is aſcribed by the writers of the time to the devaſtation made by the contending parties during the civil wars. The Commiſſioners of the Navy at that time, alarmed by the proſpect of a want of timber for the dock yards, repreſented the ſituation to the Royal Society, requeſting them to ſuggeſt a remedy ; and Evelyn, a member of that ſociety, whoſe valuable writings on foreſt trees were publiſhed at different times from 1664 to 1704, and who muſt himſelf have been a witneſs of that deſtruction of timber, ſays, “ This waſte and devaſtation was ſo univerſal, that nothing leſs “ than an univerſal plantation of all ſorts of trees could ſupply, or would “ encounter the defect ;” and he adds, “Who would not preſerve timber, “ when, within a few years, the price has quadrupled ?”

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* *Note*, It may, perhaps, be thought that a conſiderable part of this difference in price is to be accounted for by a decreaſe in the value of money ſince that time ; but if it be true that the price of corn is the beſt meaſure of the value of ſilver, it does not appear that the opinion of a great decreaſe in the value of money ſince that time, at leaſt till within a few years paſt, is well founded. A ſhilling contained the ſame quantity of ſilver in the time of James I. as it does now ; and the average price of the beſt wheat at Windſor market for 51 years, from 1595 to 1646, was 2l. 0s. 3d. the quarter, which is higher than the average price for the laſt 51 years ; and even for the laſt 18 years the average price has only been 2l. 4s. 9d. for middling wheat, and 2l. 8s. 9d. for wheat of the beſt quality ; ſo that a load of timber fit for the Navy will purchaſe at leaſt ſix times as much wheat now, as a load of the ſame kind of timber would have purchaſed in the time of James I. or Charles I.

Wiſhing to aſcertain, from official documents, what prices were paid by Government for naval timber, as far back as any accounts of ſuch tranſactions have been kept, we applied to the Commiſſioners of the Navy, by whom we were informed, that the earlieſt accounts of that nature remaining in their office begin from the Reſtoration ; and we obtained the peruſal of their contract books from 1663 to 1665, from which it appears, that they bought ſtraight and compaſs timber at various prices, from 2l. to 2l. 15s. 6d. per load ; and knee timber from 2l. 15s. to 3l. 2s. 6d. per load. Thoſe books, therefore, confirm the account of the prices mentioned by Evelyn.

From that time the value ſeems to have riſen, gradually, till 1756, when the contract prices for the purchaſe of oak timber for the navy were fixed at the rates now paid, of which an account is given in the APPENDIX (*Vide* No. 2.). No alteration has ſince taken place, except in the articles of plank and thick-ſtuff, on which there has been an addition of 10s. per load ; but the Navy-Board, finding timber difficult to be procured near to the dock-yards, or conveniently for water-carriage, inſtead of advancing the price of timber have made an allowance to the timber-merchants for long carriage, of one-half of the ſurplus expence of carriage of ſided timber, thickſtuff, plank, and knees, where it exceeds 38s. per load, as far as 15s. the Navy-Board paying from 1s. to 7s. 6d. per load, according to the actual coſt of the carriage.

Before we make any remark on this permanency of the contract prices for naval timber during ſo long a period as 34 years, while moſt other articles of conſumption have been riſing in value, we think it right to add to the ſhort hiſtory we have given of the ſtate of the timber in this country, and the prices in former times, ſome account of its preſent ſtate, and the proſpect of a future ſupply.

In the year 1771, the public attention having been drawn to this ſubject, a Committee of the Houſe of Commons was appointed, to conſider how his Majeſty's Navy might be better ſupplied with timber, and to report their opinion. Whoever reads the evidence which was brought before that Committee muſt be ſatisfied, that enough was proved to ſuggeſt apprehenſions of a ſcarcity at no very diſtant time. It appears, however, from the Journals, that the Committee moved the Houſe to have that part of the order diſcharged which required them to report an opinion. This extreme caution was, perhaps, unfortunate for the country ; for if they had given the opinion which muſt have ſuggeſted itſelf upon conſideration of the information before them, ſome means would probably have been taken by Government for increaſing the quantity, and providing a permanent ſupply of timber ; and, with that view, ſome plan might, perhaps, have been adopted, for the improvement or better management of the royal foreſts, a meaſure ſtrongly recommended by ſeveral of the perſons examined on that occaſion, and by which, at leaſt, the waſte which has ſince taken place in thoſe foreſts might have been prevented : but it is worthy of remark, that though that inquiry was inſtituted ſolely with a view to provide for the better ſupply of timber for the Navy, nothing effectual was done to promote that object.

Finding from the report of that Committee, that the Navy-Board had attempted to have a general ſurvey made of all the timber growing on private eſtates in England, but had been interrupted by the proprietors before they had got through the ſecond county, and ſeeing no reaſon to expect that what was then objected to would now be allowed, we were obliged to have recourſe to other modes of inquiry; and we have endeavoured to make up for the want of an actual ſurvey, by procuring information from as many different ſources as poſſible. A general concurrence in ſuch information may, perhaps, like circumſtantial evidence in matters of judicature, be as convincing, and deſerving of confidence, as that which, though more direct and poſitive, muſt depend on the accuracy or fairneſs of individual teſtimony.

The Commiſſioners of the Navy, in anſwer to our inquiries, informed us, that the accounts they had received, of a general decline in the quantity of great timber, correſponded with ours; and we obtained the peruſal of the anſwers which had been returned to them by their purveyors and correſpondents. That Board having made ſome progreſs in a ſimilar inquiry, and having at all times had the charge of providing the timber requiſite for the conſtruction of the navy, their opinion, founded on ſo much experience, and ſuch numerous and extenſive tranſactions, is undoubtedly entitled to the greateſt conſideration.

The purveyors employed by the Navy-Board, who ſurvey and mark every piece of timber before it is ſent to the dock-yards, having the beſt opportunities to be minutely acquainted with the ſtate of the great timber in every part of the country, we thought it right to queſtion them ſtill more particularly; and their anſwers tend to confirm the opinion given by the Commiſſioners of the Navy (Appendix, No. 3.).

We applied alſo to ſome of the moſt extenſive dealers in timber, to land-ſurveyors, and to ſome of the principal ſhip-builders; and they all concur in repreſenting the timber to be in a declining ſtate through the whole of this kingdom (Appendix, No. 4.).

But though the teſtimony of ſo many well-informed men, in different ituations, and whoſe intereſts are alſo different, ſeemed to afford a very trong preſumption that the apprehenſions of a ſcarcity were too well ounded, we wiſhed to have ſtill more particular and local information; nd, with this view, we wrote to the Chairmen of the Quarter Seſſions f every county in England and Wales, addreſſing to them ſuch queſtions s we thought beſt calculated to bring out the full information we wiſhed r. To theſe we earneſtly requeſted, that the attention of the gentlemen f the county might be called, and that their collective ſentiments might e tranſmitted to us.

From the anſwers we have received from each county, it will be found, at there has been within memory a great decreaſe of oak timber, of all ſizes, every part of England, but that great naval timber has decreaſed more an any other; and timber in hedge-rows, which is the moſt valuable r naval uſes, in a ſtill greater proportion than timber growing in oods; that the ſtock of great timber is now ſo much, and ſo generally miniſhed, in moſt counties, that they will not be able to continue to furniſh ſo large a ſupply as they have done of late years; that foreign fir timber is now much more uſed than formerly, particularly in houſe-building; that the price of underwood has riſen, notwithſtanding the more general uſe of coal for fuel; and that in ſome counties it is not uncommon to fell the oak trees when young, not ſuffering them to ſtand ſo long as to be of uſe to the Navy, for fear of their over-ſhading and deſtroying the underwood; that notwithſtanding the advance in the price of timber, tillage is gradually extended, and the quantity of woodland leſſened; and that the plantations which are now made are more generally for ornament than uſe, and of quick-growing trees in preference to oak for the Navy.

This maſs of concurring evidence from every part of England, and from men of every deſcription, who have any dealings in timber, either as buyers or ſellers, or who are likely to have any information concerning either its growth or conſumption, we apprehend can hardly leave a doubt in the mind of any perſon, that there is a great and general decreaſe in the quantity of large naval timber, notwithſtanding the additional and growing demand: and this decreaſe is the more alarming, and calls the more for the attention of the Public, from its being occaſioned, not by any temporary cauſes, but by ſuch as will probably render it in future ſtill more general and rapid. It is owing to an extenſion of tillage, rendered neceſſary by an increaſe of population; to an improved ſyſtem of farming, in conſequence of which fields are enlarged, and hedge-rows are grubbed up; to the quick returns of the profits of agriculture, and the very remote proſpect of advantage from planting with a view to naval timber; to the facility with which this country is ſupplied from other countries with fir timber, which at leſs expence anſwers for houſe-building, and many of the purpoſes to which oak was formerly applied; to the increaſed demand and preſent high price of bark, which appears to have been no more than 2s. the cart-load in the time of James the Firſt, and is now from 50s. to 3l. per coppice load, weighing from 7 to 11 hundreds, according to the quality of the bark; to the great and conſtant conſumption of oak-timber before it reaches the large ſizes neceſſary for the Navy; to the additional demand for ſmaller timber, occaſioned by the vaſt increaſe of ſhipping for the merchant-ſervice, and the prohibition of the uſe of American-built ſhips; to the general habits of diſſipation and expence, which render it unlikely that what can be ſold with advantage at any time, will in many inſtances be allowed to remain unſold for 100 years; to the practice of land-jobbers and adventurers, in buying eſtates on ſpeculation, and ſtripping them of their timber and wood, to repay part of the price; and to a variety of cauſes, which muſt be expected to increaſe, while this country continues to advance in commerce, population, and wealth.

One circumſtance only, in the account we have given, appears to us ſtill to require particular explanation; and that is, that notwithſtanding the decreaſe in the quantity of great timber, which is ſo fully proved, the *contract* prices given by the Navy-Board have not been raiſed ſince 1756. This muſt ſeem the more extraordinary, from its being alſo proved, by every information we have received, that the *current* prices of timber, of all kinds and dimenſions, have riſen within that time; for it cannot be ſuppoſed, that Government has really been ſupplied on better terms, than well-informed individuals acting for themſelves ; and the difference between the contract and the current prices of great timber, we apprehend, can hardly be accounted for in any other way than by ſuppoſing, that notwithſtanding all the care taken by the Navy-Board to procure timber on low terms for the public, ſome extraordinary advantage is obtained by the contractors, on ſome articles, in conſequence of the complicated nature of the contracts, which at leaſt makes up for this apparent difference.

It may, however, ſtill ſeem ſurpriſing, that if there has been a great decreaſe in the quantity of oak timber, the prices ſhould not, in the laſt thirty-four years, have riſen even more than they have done ; eſpecially ſince there undoubtedly has been, within that time, a great addition to the demand for Naval timber, both from an increaſed Navy, and a more extended commerce ; but this is, perhaps, to be accounted for by the following circumſtances :

It appears, that ſoon after the Reſtoration a ſpirit for planting was excited and diffuſed by the writings of Evelyn* ; and the miniſters at the time, alarmed by the devaſtation which had been committed during the civil wars, gave great attention to the increaſe and preſervation of timber in the royal foreſts, particularly the Foreſt of Dean ; and as it is almoſt univerſally allowed, that oak trees, to grow to a ſize fit for the Navy, require from 80 to 150 years, according to the quality of the ſoil, it is probable that the vaſt quantities of great timber conſumed by our Navy during the preſent reign were chiefly the produce of the plantations made between the Reſtoration and the end of the laſt century, on private property in almoſt every part of England, as well as in the royal foreſts. Unfortunately, however, the ſpirit and attention which then prevailed, did not laſt beyond that time ; and there is, perhaps, too much reaſon to apprehend, that when that ſource ſhall be exhauſted, the quantity required for the ſupply of our Navy will not eaſily be found in this country.

The improvements in roads and navigable canals, within the laſt forty years, tend alſo to account for the ſupply of the increaſed demand for Naval timber, without any conſiderable addition to the price. By leſſening the expence of carriage, they have enabled the internal parts of the country to ſend timber to the dock-yards, which, prior to thoſe improvements, could only be made uſe of near to the places where it grew. It is the quantity brought to market, not the ſtock exiſting in the country, which muſt regulate the price ; and if there are circumſtances which render that quantity for a time greater than can be permanently ſupplied, if the wants of the country, not ſatisfied with the ſupply of timber which can be annually furniſhed from its preſent reſources, are every year encroaching on the ſtock, though the immediate demand be anſwered, we may be in danger of future want, and may not feel our neceſſities till it is too late.

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* " I need not acquaint your Majeſty how many millions of timber trees, beſide " infinite others, have been propagated and planted throughout your vaſt dominions, " at the inſtigation, and by the ſole direction of this Work."

Evelyn's Dedication to Charles II.
5th December 1678.

What we have ſtated are circumſtances which muſt have tended to keep down the price of timber, even at a fair market, and where a competition exiſted; but the Commiſſioners of the Navy having no conſiderable competitor in the purchaſe of great Naval timber, except the Eaſt India Company, they muſt neceſſarily have it in their power, in a great meaſure, to regulate the price; and their conduct has been well calculated to obtain the Naval timber, for the public, at a low rate. Having gradually ſtored up, during peace, a great quantity in the dock-yards, and continuing at all times to purchaſe what was offered, without varying the price, they have avoided the danger of being obliged, on any emergency, to raiſe it; and by paying a part of the expence of long carriage, they have greatly widened the field of ſupply.

But though theſe meaſures have, during the laſt thirty-four years, occaſioned a conſiderable ſaving to the public, it may be doubted whether they have a tendency to provide a permanent ſupply for the Navy; for, though well contrived for obtaining great timber at a reaſonable price, as long as the preſent ſtock ſhall laſt, it is in part owing to them that the price of oak is not as high, when compared with the price of corn, as it naturally ſhould be in conſequence of the lateneſs of the return. It is in part owing to them, therefore, that woodlands are diminiſhed, and tillage extended; they muſt, in ſome degree, prove a diſcouragement to the planting of oak; and they have an obvious tendency to prevent more from being allowed to reach the large ſizes required for the Navy, by making it the intereſt of every perſon who has any timber, to cut it while it is of a ſize for which there is a competition.

We know it is not an uncommon opinion, nor unſupported by writers of great authority, that a decreaſe of the quantity of timber, in proportion to the demand for it, ſuppoſing it were proved, is an evil which muſt produce its own cure; and that, as the quantity leſſens, the price muſt riſe, and give encouragement to new and more extenſive plantations, which muſt again ſupply the demand.

But though the natural conſequence of a temporary ſcarcity of corn, or of any other produce of land of which a ſupply can be obtained in one year, is, that more land is immediately converted to the production of thoſe articles, by which the evil is ſoon remedied, there are many circumſtances which prevent a ſimilar effect from a ſcarcity of great Naval timber. The expence of planting and fencing againſt injury from cattle, the paſſion of the day in favour of improvements in agriculture and pleaſure-ground, and the remote proſpect of a return of profit, never to be expected during the life of the planter, counteract the inducement to plant; and men are naturally driven to other reſources which are more immediate. The deficiency is ſupplied by gradually importing a greater quantity from other countries, in which cultivation is not ſo far advanced, and where ſome of the beſt of the ſoil is ſtill covered with wood; and this foreign ſupply, by preventing the price from riſing ſo high as it would otherwiſe do, in conſequence of the decreaſe at home, leſſens at the ſame time the expectation of advantage to be derived from planting, eſpecially of ground already profitably employed in agriculture.

On the moſt attentive conſideration of the ſubject, and of all the materials we have collected, we think ourſelves warranted in forming this concluſion, That in conſequence of the proſperity of this country, and of its progreſſive advancement in population and induſtry, there has been from early times a gradual extenſion of tillage and paſture, and a gradual diminution of the wood and timber; and that this is an effect naturally to be expected in every future ſtage of its improvement.

PART II.

Of the Laws relative to Timber on private Property, and to the Royal Foreſts.

IN reviewing the ſtate of timber in this country from the earlieſt times, and peruſing the Acts of Parliament which have been paſſed relative to it, there appear to be three diſtinct periods:

The firſt period comprehends the time preceding the year 1535, when Henry the Eighth ſeized the poſſeſſions of the Monaſteries:

The ſecond period may be reckoned from that time to the end of the laſt century:

And the third, from thence to the preſent time.

During the firſt of theſe periods, timber appears to have been of little or no value; and though various Acts of Parliament were paſſed, empowering the owners of woods and waſte lands, in which others had common of paſture, leaving ſufficient for the commoners, to "incloſe and *approve*" the reſidue, we do not find any laws for encouraging the growth of timber until after the end of the period firſt mentioned.

During the ſecond period, the quantity of timber having been conſiderably diminiſhed, various laws were enacted, which had for their object its increaſe and preſervation, but which, according to the miſtaken policy of thoſe times, impoſing reſtraints on the uſe and management of private property, have been attended with no beneficial effect, and have long been very generally diſregarded. By theſe Acts, the owners of woods in which others have common of paſture are prohibited from felling ſuch woods, until a fourth part of them has been ſet out, divided, and incloſed; and thoſe incloſures are required to be preſerved for nine years. Penalties are inflicted for injuring, deſtroying, or carrying away any timber trees or underwoods. The owners of all coppices felled at twenty-four years growth, or under, are required to leave on every acre twelve ſtandils or ſtorers, which are not to be cut before they become ten inches ſquare, three feet from the ground. The owners of woods or coppices ſet with great trees, above the age of twenty-four years, are to leave twelve trees of oak on every acre, to remain twenty years after the felling of ſuch woods; the turning into tillage or paſture any coppices or underwoods of more than two acres, was prohibited, under heavy penalties; and the exportation of wood without licence, or the converting any ſound timber tree, of one foot ſquare, into coal for the making of iron, are ſtrictly prohibited.

Among the Acts which impoſe reſtraints on the management of woods in private property, may alſo be conſidered that by which the felling of oak trees at any other time than between the firſt day of April and the laſt day of June was prohibited, in all places where bark was worth 2s. a cart-load, over and above the charges of barking and pilling, except timber to be employed in building or repairing houſes, ſhips, or mills; and among the laws for the encouragement of the growth of timber, we muſt reckon that by which timber and bark are exempted from the payment of tythes, and alſo the ſeveral Acts by which duties are impoſed on the importation of foreign timber.

By many Acts paſſed during the third period, penalties are impoſed for injuring, deſtroying, or carrying away, any timber trees or underwood; and the King, and all other owners of waſtes, woods, and paſtures, wherein there is right of common, are enabled, with the aſſent of a majority in number and value of the commoners, to incloſe any part of ſuch waſtes, woods, and paſtures, for the growth and preſervation of timber or underwood, upon ſuch conditions as may be agreed on between the parties intereſted.

During the courſe of our inquiries, many plans have been ſuggeſted to us for promoting and increaſing the growth of oak. A more ſtrict execution of the Act of Henry the Eighth by which every proprietor of woods is required to leave twelve ſtandils on every acre, at the cutting of the underwood, has been recommended by ſome;—and others have adviſed that premiums ſhould be given by Government.

But with regard to the firſt of thoſe propoſitions, we cannot believe that the interference of Government, to put reſtraints on the diſpoſal or management of any particular kind of produce, would be a likely way to promote its increaſe; nor ſhould we ſuppoſe that much ſecurity of a proviſion of timber for the Navy, in future times, would be derived from allowing premiums for the *planting* of oaks which muſt ſtand one hundred years, before they become fit for naval uſe, and which muſt be, all that time, at the free diſpoſal of the Proprietor.

This, however, is not the only objection we have to this mode of encouraging the growth of oak.

It appears from a late Report of the Committee of the Privy Council on the Corn Laws, that, for the laſt eighteen years, all the land hitherto cultivated in this country, does not produce a ſufficient ſupply for the inhabitants; and that large quantities of corn are annually imported. Under ſuch circumſtances, premiums to extend the wood, and leſſen the quantity of tillage, can hardly be thought adviſeable: but if means could be found to encourage the improvement of uncultivated land, ſome addition to the quantity of timber, as well as to the corn, would probably be derived from it. Under the Acts of 29th and 31ſt Geo. II. enabling the owners of waſtes, woods, and commons, by agreement with the commoners, to incloſe any part thereof, for the growth of timber, ſome benefit has ariſen; but the difficulty of obtaining the conſent of a majority of the commoners prevents the good effects of it from being very general; and any law which would render the diviſion of waſtes, woods, and paſtures, on which there are rights of common, more eaſy to be obtained, and at leſs expence than at preſent, would, we apprehend, be the moſt effectual which could be paſſed for the increaſe of timber on private property, particularly of hedge-row timber, which, as we have before obſerved, is the moſt valuable for naval purpoſes.

The royal foreſts were formerly conſidered and maintained chiefly as places of ſport for our Kings, and have always been ſubject to laws and regulations peculiar to themſelves. The Acts concerning them paſſed during the firſt-mentioned period, like thoſe relative to private property, do not appear to have had the increaſe or preſervation of timber for their object; but were intended principally for the protection of the deer, or the regulation of the rights of common enjoyed by the inhabitants within the regard of the foreſts. "Much of theſe," ſays Evelyn, ſpeaking of the Foreſt Laws, "concerned the royal game, when, as to the timber-trees, the whole iſland was almoſt but one vaſt foreſt, and wood ſo abounding, that what people might have had almoſt for carrying off the ground it grew on, is now ſo ſcarce in thoſe very places, as that fuel is ſold by weight."

The rights of common were exerciſed under ſuch limitations as rendered them by no means inconſiſtent with the purpoſes for which the foreſts were then kept. The cattle of the commoners were entitled only to the ſurplus herbage, above what was neceſſary for the deer. They were not allowed to be in the foreſt during the fawning month, in ſummer, nor during the time of winter haining; and no greater number were to be ſent from any eſtate than that eſtate could maintain, *levant* and *couchant* thereon, at all times of the year. No ſheep or goats were allowed to be admitted at any time; nor any ſtoned horſes under a certain ſize, and ſwine were admitted only during the time of pannage. For fuel, the commoners could only take dead wood, bearing no green hue; and though the timber, from its great plenty, was of little value, the trees were protected, as affording covert and ſuſtenance for the deer. The laws were extremely ſevere; and the officers in every foreſt ſo numerous, that an offence could hardly eſcape detection.

Under ſuch management, little prejudice to the property of the Crown could ariſe, from rights of common ſo limited. They appear, indeed, to have been no more than a fair compenſation for the injury done by the deer to the private eſtates within the perambulation of the foreſt; and in that light they were conſidered, for when any eſtate became diſafforeſted, and no longer ſubject to the range and haunt of the deer, it was, by law, deprived of the privilege of common in the part of the foreſt belonging to the Crown.

As timber increaſed in value during the ſecond period, and became a ſource of revenue to the Crown, the royal foreſts were, on that account alſo, an object of the care and protection of Government; and the laws paſſed within that period, for the improvement of Dean and New Foreſts, contain very wiſe regulations for the increaſe and preſervation of the timber.

In conſequence of the Act for Dean Foreſt, paſſed in 1668, eleven thouſand acres were ſpeedily incloſed, and planted, and the trees in them regularly thinned, and protected, till they were paſt danger from cattle; and in New Foreſt, immediately after the paſſing of the Act in 1698, one thouſand acres were alſo incloſed and planted But ſo ſudden was the change in the management of the foreſts, after the commencement of the preſent century, that the incloſures which had been made in New Foreſt were neglected, and the trees ſuffered to grow up ſo cloſe for want of proper thinning, that few of them are likely ever to be fit for the uſe of the Navy; and though the Act provided that 2,000 acres ſhould be incloſed within two years, and two hundred acres more yearly, for twenty years following, making 6,000 acres within that time, no other incloſures beſides the firſt 1,000 acres were made for more than fifty years afterwards. Both theſe Acts contained powers for making farther incloſures, on throwing open thoſe firſt planted, when the trees ſhould be paſt danger from deer and cattle, and under thoſe powers the whole of Dean Foreſt, containing 23,000 acres, might before this time have been ſucceſsfully incloſed, and completely covered with great timber, and not leſs than 24,000 acres planted in New Foreſt, in addition to the former woods: yet theſe valuable powers have been ſo far neglected, that there are now, in Dean Foreſt, only four ſmall incloſures, containing about 660 acres; and the whole of the plantations in New Foreſt, ſince thoſe firſt made, contain only 2,274 acres, of which about 800 acres are entirely deſtroyed by rabbits bred by the keepers for their own profit.

But what relates to the careful management of the foreſts in former times, and particularly during the latter part of the laſt century, when various officers co-operated in the ſuperintendance of them; the unfortunate change which took place at the beginning of the preſent century, when the foreſts were left under the ſole management of a Surveyor-General, without any *effectual* check or controul; the ſubſequent relaxation and neglect in the officers in the department; the unwiſe and improvident mode of paying them by *fees*, *perquiſites*, and *poundages*, inſtead of ſalaries; the waſte of the timber, and profuſion in the expenditure, on all works done in the foreſts, which have been the natural conſequences of that abſurd ſyſtem, are all ſo fully taken notice of in our former Reports (3d, 5th, 6th, and 7th,) that we ſhall forbear to make any farther obſervations on them, or to ſuggeſt the alterations which we ſhall think it our duty to propoſe in the general management of the foreſts, until we have had the demiſed eſtates fully under conſideration; thinking it probable, that we may judge it expedient for the public to recommend that the whole of the landed property of the Crown ſhould be under the joint ſuperintendance of one ſet of officers.

At preſent, therefore, we ſhall only obſerve, that the limitations on the rights of common in every foreſt ſeem to have been loſt ſight of; that numerous encroachments have been made, and intruſions, and claims originally ill founded, ſuffered to gain ſtrength, from long, and in many caſes, uninterrupted poſſeſſion; and that unleſs ſome plan ſhall be ſpeedily adopted for the prevention of thoſe abuſes, the rights of the Crown in the foreſts will become of little value: that from the year 1730 to 1787, the whole of the foreſts, parks, and chaſes, belonging to the Crown furniſhed to the dock-yards only 77,256 loads of oak timber, being, on an average of fifty-ſeven years, no more than 1,356 loads annually; that inſtead of yielding any clear revenue to the Public, the value of all they have produced has been expended on them, and a great ſum beſides taken from the revenue of the demiſed eſtates, ſo that they have hitherto been a ſource of expence, and not of profit; and yet that they now contain much leſs timber than in former times.

A more ſtriking picture of the decreaſe of timber in the foreſts cannot, perhaps, be given, than by a compariſon of the ſurvey in 1608, mentioned in the former part of this Report, with another ſurvey taken by order of the Houſe of Commons in 1783, as to ſuch of the foreſts under our conſideration as were ſurveyed at both thoſe periods.

	In 1608.		In 1783.	
	Timber fit for the Navy.	Decayed Trees.	Timber fit for the Navy.	Decayed Trees.
	Loads.	Loads.	Loads.	Loads.
New Foreſt	115,713	118,072	33,666	1,713
Aliceholt and Woolmer	13,208	23,934	6,985	5,924
Bere Foreſt - -	4,258	8,814	161	175
Whittlewood Foreſt	45,568	1,472	4,820	7,200
Salcey Foreſt -	23,902	1,673	2,497	5,653
Sherwood Foreſt -	31,580	111,180	2,326	14,889
	234,229	265,145	50,455	35,554

So that the quantity of timber in 1783, in thoſe foreſts, was little more than one-ſixth part of what it was at the former period.

In our Reports on the ſeveral Foreſts, we have propoſed ſuch plans of ſettlement with thoſe who now enjoy rights of common, as we judged would be of advantage to them, as well as to the Public. We have propoſed that the deer ſhould be removed; and the eſtates ſubject to the burthen of the Foreſt Laws exonerated from every foreſtal right; that in return for both thoſe advantages to the commoners, the incloſures for the growth of timber ſhould be proportionably increaſed; and as theſe objects could not be attained without ſome alteration in the property of the parties intereſted, that the equivalent to be given for every ſuch change ſhould be determined by Commiſſioners, or Arbitrators, choſen by the Crown and the commoners, and acting on oath, if the terms propoſed on the part of the Crown ſhould not be acceded to by thoſe intereſted.

In our Sixth Report we have obſerved, that thoſe Acts which relate only to ordinary waſtes and commons ſufficiently ſhew the deſire of the Legiſlature to remove the obſtacles to improvement, but that the reaſons for the interpoſition of Parliament, in order to ſeparate thoſe mixed rights in the Royal Foreſts, are much more urgent than in other property; for in ordinary caſes of commons and waſte lands, the evil is confined to the waſte itſelf, but in the Royal Foreſts it extends much farther; the private eſtates within the perambulation ſuffer conſiderably from the range of the deer; and the unlimited right of the Crown to increaſe the number, not only ſubjects thoſe eſtates to ſtill greater injury, for which the Proprietors at preſent are without any remedy, but puts it alſo in the power of the Crown to render the rights of paſture of little or no value to them.

But beſides theſe reaſons, which ſhew that the ſettlements we have propoſed are for the advantage of the parties intereſted, a far ſtronger reaſon for the interpoſition of Parliament remains: the public intereſt requires, that ſuch a ſeparation of rights ſhould be made as will admit of the improvement of the foreſts for the growth of timber; and we have therefore ventured to give it as our opinion, that even though, in ſome inſtances, a majority of thoſe enjoying right of common in the foreſts ſhould not be prevailed upon to give their conſent to the arrangements neceſſary for that purpoſe, ſo great a national object ſhould not be loſt or obſtructed by the unreaſonable oppoſition of a few; but that ſuch a ſhare of each foreſt, as ſhall be found to be equivalent to the juſt rights of the Crown, ſhould be ſet apart, and incloſed as a nurſery of timber for the Navy, leaving it in the option of the commoners ſtill to enjoy the reſidue in common, if they ſhall think *that* more adviſable than to agree to a general diviſion.

PART III.

Of the Conſumption of Oak Timber, and particularly for Naval Purpoſes.

THE conſumption of oak timber in this kingdom falls under three general heads:

The firſt compriſes the quantity required for the internal purpoſes of the country, in which timber of all ſizes is uſed:

The ſecond, which is confined chiefly to the timber of middling ſize, includes what is employed in building Ships for the whole trade of the kingdom (except that of the Eaſt India Company), and for tranſports and other veſſels employed in the ſervice of Government.

And the third comprehends the great timber uſed in the conſtruction of ſhips of war, and of thoſe employed by the Eaſt India Company.

Any attempt to aſcertain the quantity of the timber conſumed in the internal uſes of the country would, we apprehend, be found impracticable; and even if the quantity could be aſcertained, ſtill, as no ſimilar eſtimate was ever made at any former period, it would be impoſſible to give a comparative ſtatement, ſo as to ſhew the increaſe or diminution.

In what relates to the firſt part, therefore, an opinion can be founded only on general obſervation and inquiry.

The conſumption of oak timber in houſe-building is certainly not ſo great as it was in the laſt century. In re-building London, after the fire in 1666, no other timber than oak was allowed to be uſed, in the roof, door, window-frames, or cellar floor of any houſe; but in the great additions which have lately been made to the capital, and to many other towns in this kingdom, a very ſmall proportion of oak timber has been made uſe of.

Probably even within the laſt forty years, the conſumption of oak timber in buildings, in many parts of England, has decreaſed. The improvements in roads and Inland Navigation, which enable the internal parts of the country to ſend their oak to the dock-yards, afford them at the ſame time the means of importing, at leſs expence, foreign fir timber, which anſwers moſt of the purpoſes of houſe-building, perhaps, as well as oak. The annexed account of pine timber and deals imported into this country, at three different periods, proves, how rapid the increaſe of the conſumption of fir timber has been within the laſt ſeventy years. The books of the Cuſtom Houſe will ſhew that very little foreign oak is uſed in this country. During the laſt year, the quantities imported were 3,393 loads of oak timber, and 6,606 loads of plank. The quantities cannot be given with accuracy at any early period, but appear never to have been conſiderable.

The ſame improvements in roads and canals having alſo rendered the uſe of coal more general, leſs wood or timber is now probably conſumed for fuel; and the art of charring pit-coal, lately diſcovered, has prevented the conſumption of wood and timber in the ſmelting of iron from being ſo very great, as, from the prodigious increaſe of that manufacture, it muſt otherwiſe have been.

But, on the other hand, the conſumption of oak timber in mill work, engines, and machinery of various kinds, in lighters, barges, and boats, piers, bridges, wharfs, locks, and ſluices, in wheelwrights and coopers works, park pales, poſts, and rails, and many other articles which fir timber is not fit for, and which depend on the population, manufactures, commerce, agriculture, and wealth of the country, is increaſed to ſuch a degree, as we apprehend at leaſt counterbalances the ſaving occaſioned by the diſuſe of oak for houſe-building, or other domeſtic uſes.

In order to aſcertain, as accurately as poſſible, the conſumption of oak timber under the ſecond head, we have obtained from the Cuſtom Houſe an account of the total number of ſhips, and their tonnage, belonging to the ſeveral ports in Great Britain, in the year 1755, and in every fifth year following, to the year 1785, incluſive; an account of the number of ſhips and veſſels, with their tonnage, belonging to and regiſtered at the ſeveral ports in his Majeſty's dominions in the years 1788, 1789, and 1790, diſtinguiſhing England, the Iſland of Guernſey, Jerſey, and Mann, the Britiſh Plantations, Scotland, and Ireland; and an account of the number of trading veſſels, with their tonnage, which appear by their regiſtry to have been built in England and Scotland, the Iſlands of Guernſey, Jerſey, and Mann, and the Britiſh Plantations, in the years 1787, 1788, 1789, 1790; and we have alſo received from the Navy, Victualling, Ordnance, Cuſtoms, Exciſe, and Poſt Offices, returns of the tonnage of veſſels employed in thoſe departments; and the amount of the whole, on the 30th of September 1790, was no leſs than 1,480,990 tons.

The quantity of timber, in its rough ſtate, uſed in the conſtruction of merchant ſhips, in proportion to their burthen, being, according to the information we have received about a load and a half to a ton, the timber requiſite for the conſtruction of that quantity of ſhipping is no leſs than 2,221,485 loads; and the medium duration of ſhips being about fourteen years, the annual conſumption of oak timber, under this head, cannot be ſtated at leſs than 158,679 loads.

Campbell, in his Naval Hiſtory, after ſtating the tonnage of the ſhips of war at the death of Queen Elizabeth at 16,915 tons, which differs but little from the account we have received from the Navy Board, adds, that "the number of all other ſhips, merchant ſhips as well as other, in "all places of England, of one hundred tons and upwards, was then one "hundred and thirty-five; and the ſum of all barks and ſhips of forty "tons and upwards, to one hundred tons, ſix hundred and fifty-ſix."

We wiſhed to trace the progreſſive advancement of the private ſhipping from that period, in order to ſhew the increaſe of conſumption of timber under this head; but we found it impracticable by any other means than by the analogy which the amount of the tonnage bears to the value of the trade; for, prior to the year 1787, when the Act "For "the further Increaſe and Encouragement of Shipping and Navigation" was paſſed, no ſuch accounts of the tonnage of trading veſſels were kept as can be relied on. The ſhips were not meaſured, as they now are, by the officers of the revenue; and the accuracy of the accounts of the tonnage depended on the fairneſs of the report of the Captains, who had an intereſt in ſtating it differently from the truth.

Leaving, therefore, accounts which muſt be erroneous, we ſhall, in the annexed ſtatement, give a view of the progreſſive increaſe of imports and exports in every tenth year, from 1700 to 1790; from which it will be found, that between the years 1700 and 1750, the annual imports for England only had increaſed from £5,907,175. 1*s.* 10*d.* to £7,772,039. 12*s.* 5*d.* and the annual exports from £7,302,716. 8*s.* 7*d.* to £15,132,004. 3*s.* 1*d.*; and that the increaſe for Great Britain, from 1760 to 1790, is as follows;

	Imports.			Exports.		
	£.	*s.*	*d.*	£.	*s.*	*d.*
In 1760 -	10,683,595	10	4	16,665,278	5	1
1770 -	13,430,298	3	1	16,636,872	4	0
1780 -	11,714,967	7	11	13,689,073	12	6
1790 -	19,130,886	5	3	21,643,953	1	2.

From this account it appears, that the amount of exports and imports in 1790 was more than three times as great as that for England in 1700; and it is fair to ſuppoſe, that there has been a proportional increaſe of ſhipping. The conſumption of Britiſh oak timber for trading veſſels is probably even greater at this time, in proportion to the value of the trade, than it has been at any former period, becauſe the whole muſt now be carried on in Britiſh bottoms; whereas, prior to the loſs of America, there were many American-built ſhips employed in our trade; and before the paſſing of the Manifeſt Act, foreign-built ſhips might be employed in ſome branches of it.

We have endeavoured to diſcover what was the amount of the tonnage of American-built veſſels employed in the trade of Great Britain before the late war; but, owing to the looſe manner, already mentioned, in which ſhips were then regiſtered, it cannot now be ſtated with accuracy.

Mr. Irving, the preſent Inſpector General of the imports and exports of Great Britain, who formerly held a ſimilar office in America for the trade of that country, informs us, in anſwer to our inquiries on this ſubject, that veſſels, in order to evade the payment of light-houſe money, and various port charges collected upon tonnage, were generally regiſtered conſiderably under the real burthen; that he has, in many inſtances, compared the regiſtered tonnage, under the Act of King William, with the admeaſured tonnage of the ſame veſſels, under the late Act, and found the average proportion to be as two to three; and he has given us an account, taken from the books of his former office, of the ſhips built in three years in the different Provinces in North America, of which the totals are as follow:

	1769.	1770.	1771.
Regiſtered tonnage	21,370	22,174	26,150
Addition to make it equal to the admeaſured tonnage	10,685	11,087	13,075
Real tonnage	32,055	33,261	39,225

Mr. Irving adds, that after having been at great pains to form from thoſe books the beſt eſtimates in his power of the tonnage of American-built ſhipping, prior to the ſeparation of the two countries, he is of opinion, that about 210,000 tons of ſuch ſhipping may be reckoned to have been conſtantly employed in the trade of Great Britain, and that, to keep up this ſtock, about 17,000 tons of ſhipping muſt have been annually built in the Provinces which now form the American States. If this opinion be well founded, and we conceive no perſon has better means of judging than that able and diligent officer, the addition to the annual conſumption of oak timber in this country, in conſequence of that trade being now carried on in Britiſh-built ſhips, muſt be about 35,500 loads, that being the quantity of timber which it will appear, from what we ſhall ſtate in the ſubſequent part of this Report, is requiſite for the conſtruction of 17,000 tons of ſhipping.

Mr. Irving ſtates farther, that "We poſſeſs at this time upwards of "350,000 tons more of ſhipping than we did in the moſt flouriſhing "period before the late war."

The conſumption of oak timber under the third head has been increaſing with very little interruption for a long ſeries of years.

England could hardly be ſaid to have a fleet before the time of Henry the Eighth. He laid the foundation, and ſettled the conſtitution of the Royal Navy. The amount of the tonnage of the ſhips of war of all kinds, at his death, was 12,455 tons. During the reign of Edward VI. it had declined to 11,065; and at the death of Mary it was only 7,110. The Navy was improved and increaſed by Queen Elizabeth; but even at her death the whole tonnage of the ſhips of war was only 17,110 tons. The ſtate of the Navy is not exactly known at the death of James the Firſt, but it had been ſomewhat augmented; and even in the diſturbed reign of Charles the Firſt, a very conſiderable addition took place. A farther increaſe and improvement was made during the adminiſtration of Cromwell. At the Reſtoration the tonnage was 57,463 tons. At the death of Charles the Second, it had riſen to 103,558. The Navy was put into much better condition by James the Second; but the tonnage during his reign was reduced to 101,892 tons. By King William it was raiſed to 159,017. At the death of Queen Anne, it contained 167,171 tons; and at the death of George the Firſt, 170,862. The tonnage of the Navy was ſomewhat lower at the commencement of the difference with Spain in 1738, than it was in 1727; but ever ſince that time the increaſe has been far greater, and more rapid, than at any former period. At the acceſſion of his preſent Majeſty, the tonnage was 321,104, and at the end of the year 1788, it had riſen to no leſs than 413,667 tons.

	Square Meaſure.	
We have already ſtated in our Fifth Report, on the authority of the Commiſſioners of the Navy, that the quantity of oak timber of Engliſh growth delivered into the Dock Yards from his Majeſty's acceſſion, in October 1760, to the end of the year 1788, was -	768,676 Loads.	
And the quantity of timber eſtimated by them to be uſed in the conſtruction of the ſhips built in the merchants yards during the ſame time - - - -	516,630	
		1,285,306
To which muſt be added the foreign oak timber uſed within the ſame period, which is eſtimated to have contained, in its rough ſtate, - - - - - -		137,766
The quantity of Engliſh oak remaining in the dock yards in October 1760, was - - - - - -		36,288
And of foreign oak in eſtimated rough contents -		6,397
		1,465,757
From that total is to be deducted the quantity of Engliſh oak timber remaining in the dock yards on the 31ſt December 1788 - - - -	45,232	
And of foreign oak - - -	5,339	
		50,571
The remainder is the conſumption of Britiſh and foreign oak for the Navy, in thoſe twenty-eight years, -		1,415,186
Being one year with another - - -		50,542

Th

The increaſe of the conſumption of timber, in the conſtruction of the ſhipping of the Eaſt India Company, has been ſomewhat ſimilar to that of the Royal Navy. From the date of their firſt charter, in the 43d of Queen Elizabeth, the general tonnage of their ſhipping increaſed gradually till the year 1771, when it amounted to 61,000 tons. By an act paſſed in 1772, the Company was reſtrained from building any ſhips until their whole tonnage ſhould be reduced to 45,000 tons. This reduction being effected in 1776, the Company began again in that year to increaſe their ſhipping; and the whole amount of their Engliſh-built ſhips at the preſent time is 79,913 tons, being about ſeven times as great as the tonnage of the Royal Navy was, at the time of the defeat of the Spaniſh Armada, when it amounted only to 11,850 tons; which, it may alſo be obſerved, is only about a 35th part of the tonnage of the Navy at the preſent time.

It appears from the examination of Mr. Snodgraſs (APPENDIX, No. 5.), the experienced and very intelligent Surveyor of Shipping of the Eaſt India Company, that the quantity of oak timber, in its rough ſtate, uſed in the conſtruction of their ſhips, in proportion to their burthen, is about one load and a half to a ton; and conſequently, that in the building of the whole of the ſhips now in their ſervice, 120,000 loads of oak timber muſt have been conſumed; that the ſhips in that trade, which formerly were broken up and ſold at the end of their fourth voyage, being now more carefully and ſubſtantially built, may be expected to go ſix voyages, but not more; and that thoſe ſix voyages might be performed in twelve years; but from the ſhips being kept ſome conſiderable time at home between each voyage, the whole ſix voyages are not performed in leſs than fourteen years; that after that number of voyages, they are deemed no longer fit for their ſervice, and are then ſometimes ſold, but more commonly broken up; and that of the laſt eighteen ſhips required to be replaced in their ſervice, eleven were broken up, two loſt, one burnt, and only four were ſold, the India ſhips being of too great a ſize for any other branch of the trade of this country.

From this information it follows, that the whole of the ſhipping of the Eaſt India Company muſt be completely renewed, or re-built, every twelve or fourteen years, notwithſtanding the late improvements in the mode of building their ſhips; and that the conſumption of oak timber, in the trade of that Company, is 120,000 loads every twelve or fourteen years; or, on an average, from 8,300 to 10,000 loads, annually, excluſive of what is conſumed in the repairs of thoſe ſhips.

	Square Meaſure, Loads.
From the preceding ſtatements it appears, that the average quantity of rough timber required for conſtructing the ſhipping at preſent employed in the trade of this country, and for tranſports and other veſſels in the ſervice of Government, is, one year with another, - - - -	158,679
Excluſive of what is required for the ſhipping of the Eaſt India Company, which is from 8,300 to 10,000 loads yearly, the medium being - - -	9,150
And for the Royal Navy - - - - -	50,542
So that the whole conſumption of naval timber in this country is yearly not leſs than - - - -	218,371

beſides what is uſed in the conſtruction of lighters, barges, and other ſmall veſſels, employed in the various ports and harbours, and upon the rivers and navigable canals within the kingdom, which muſt alſo be very conſiderable.

Though we have not the means of aſcertaining either the progreſſive increaſe or preſent amount of the conſumption of oak timber for the internal uſes of the country, yet, on a full conſideration of all the circumſtances we have ſtated, we apprehend no doubt can remain of the whole conſumption of timber, under all the three heads, being immenſely increaſed, while the quantity growing, both in woods and in hedge-rows, has been very much diminiſhed.

This decreaſe in the quantity of the growing timber appears to have been more conſiderable in the great timber fit for the Navy, than in timber of a leſs ſize; and all the cauſes which have been aſſigned for the decreaſe of timber in general, are ſuch as render it probable, that a ſmaller proportion of the growing timber will, in future, be allowed to ſtand ſo long as to reach the great ſize which ſhips of war require.

On the whole, we are perſuaded we ſhall not be thought to go beyond what is warranted by the information before us, when we form this concluſion, That if the proſperity of this country ſhall continue, the conſumption of oak timber for its internal purpoſes, and for the ſhipping neceſſary for the whole of our trade, including that of the Eaſt India Company, will, at no very diſtant period, furniſh an ample demand for all that can be expected to be produced on private property in this kingdom; and that ſuch is the preſent ſtate of the growing timber, and the proſpect of future ſupply, that this country will in all probability experience a *fatal* want of great oak timber, and become dependent on other Powers for the means of ſupporting her Navy, if care be not taken to provide a ſupply in future, by the improvement and better management of the Royal Foreſts, and to reduce the conſumption of it, by the utmoſt care and frugality in the expenditure.

PART IV.

Of the Supply of Naval Timber, and other Advantages, to be expected from the Improvement of the Foreſts.

THAT we might be enabled to ſhew what ſecurity of a perpetual ſupply of timber for the Navy may be derived from the improvement of the Royal Foreſts, we have endeavoured to aſcertain the extent of ground which would be neceſſary to furniſh the quantity of timber required for that purpoſe.

The moſt prevailing opinion among experienced Surveyors, and perſons converſant in the management of wood, appears to be, that on good ſoil, where great timber is made the principal object in the management,

nagement, and the young trees are regularly thinned out, and the fineſt preſerved for timber, without regard to the underwood, forty trees may be expected to grow on the acre; and that at one hundred years growth thoſe trees may be computed to contain, one with another, two loads of timber: But, in all woodlands, of any conſiderable extent, there are vacant parts, where, from different cauſes, the trees have failed; and on referring to the ſurveys taken in the time of James the Firſt, when we know there had been a very careful management, though the quantity of timber was, in general, near ſix times greater than is now upon the ſame ground, we find no example of ſo many as forty trees of two loads each per acre, through the whole of any foreſt. Making allowance, therefore, for ſuch defects, we think that 34 trees, of one load each, girt meaſure, may be expected on the acre, in a fit ſoil, and under proper management; and thirty-four loads of timber, girt meaſure, being equal to fifty loads ſquare meaſure, the produce of one thouſand acres, which would be about 50,000 loads, would be ſufficient for the ſupply of the Navy for one year, the average yearly conſumption being, as we have before ſtated, 50,542 loads: conſequently, ſuppoſing one hundred years to be the time neceſſary for an oak to attain the ſize of one load of timber, girt meaſure, and each thouſand acres to be re-planted immediately after the trees have been felled, 100,000 acres would be the extent of ground requiſite to furniſh an annual fall of 50,000 loads, ſquare meaſure. That quantity of ground is, therefore, neceſſary to be ſet apart for the perpetual ſupply of the Navy with oak timber, if the conſumption ſhall continue to be as great as it has hitherto been ſince the commencement of the preſent reign; and according to the ſame computation, the extent of ground which is neceſſary for ſupplying all the timber required for the whole ſhipping of this country, both for the Royal Navy and private trade, is 436,742 acres (being ſomewhat more than 682 ſquare miles) of which the produce of 4,367 acres muſt be felled every year *.

The opinions of the Surveyors, and other perſons acquainted with the growth of timber, whom we have examined, vary much, as to the age at which an oak arrives at maturity; and different periods have been named by them, from eighty to one hundred and fifty years. This muſt depend very much on the nature of the ſoil; and though, in the foregoing computation, we have ſuppoſed them to be felled at one hundred years growth, we are inclined to believe, that in moſt ſoils they continue much longer in an improving ſtate; but as the trees, if they are allowed to ſtand longer, will contain more than a load of timber on an average, the difference in point of time will be made up for by the increaſe in the ſize and value of the trees.

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* *Note.* Timber of ſeventy or eighty years growth may probably be of ſufficient ſize for building trading ſhips; but, on the other hand, nothing is here allowed for their repairs. There can be no pretence to *great* accuracy in any computation of this kind, it is only intended to give ſome general idea of the extent of ground which probably muſt be employed in the ſupply of the whole ſhipping of this country; and the principles on which the computations are made being given, thoſe who think differently from us, either as to the age at which an oak comes to maturity, the number of trees to be expected on the acre, the duration of ſhips, or any other particular, may eaſily make the calculation themſelves, and draw a concluſion on their own principles.

Their opinions differ no leſs as to the mode of managing woods; ſome recommending the bringing up of trees of different ages in the ſame wood, and as often as any of them arrive at maturity to fell thoſe trees, and leave the reſt ſtanding, to be cut in ſucceſſion; while other perſons of equal ſkill adviſe, that when the greater number of the trees in the ſame wood arrive at their full ſize, the whole ſhould be cut down, and that the ground ſhould be completely cleared and re-planted, in the manner we have propoſed.

In each of theſe modes, nearly the ſame quantity of ground would be neceſſary for producing a given quantity of timber. Leaving it, therefore, to be determined by thoſe to whom the management of the Royal Foreſts ſhall be committed, which mode of cultivation is the moſt eligible, we have choſen to ſtate our computation from the laſt, as being not only recommended by the majority of thoſe whom we have conſulted on the ſubject, but appearing likewiſe to be the moſt ſimple, and beſt adapted to the various wants of the Navy, which require timber of all ſizes.

After aſcertaining the quantity of ground neceſſary for the perpetual ſupply of the Navy with timber, the objects which come next under conſideration are, Firſt, The extent of the foreſts at preſent belonging to the Crown; and, Secondly, What part of them, of a proper ſoil for the growth of oak, may be expected, on a ſettlement with thoſe having rights upon them, to be allotted to the Crown.

The following ſtatement will ſhew the extent of the land in which the timber belongs to the Crown, in each of the foreſts which have been ſubmitted to our inquiry, viz.

	Acres.	R.	P.
In New Foreſt - - - -	66,942	3	26
Dean Foreſt - - - -	23,015	3	29
Aliceholt and Woolmer Foreſt -	8,694	1	31
Whittlewood Foreſt - - -	4,850	3	32
Salcey Foreſt - - - -	1,847	0	23
Whichwood Foreſt - - -	3,709	3	5
Waltham Foreſt - - -	3,278	3	2
Sherwood Foreſt - - -	1,466	3	10
Bere Foreſt - - -	926	2	13
Sulehay Walk in Rockingham Foreſt -	860	3	23
	115,594	0	34

Although any computation which might be made as to the ſecond object, before an actual ſettlement has taken place with thoſe who have claims on the foreſts, muſt be liable to error, yet we are perſuaded no extravagant expectation is held out, when we ſuppoſe, that in the whole of thoſe foreſts the allotments to the Crown may, all together, amount to 60 or 70,000 acres, fit for the growth of oak.

If only 700 acres, being one hundredth part of the quantity laſt mentioned, ſhall be incloſed and planted every year, until the plantation of the whole 70,000 acres ſhall be completed, they will, if kept under proper management, according to the computation we have before given, furniſh a perpetual ſupply of at leaſt 35,000 loads of oak timber annually, from the time that the firſt planted trees arrive at one hundred years growth.

This, however, is only ſtated in order to give a clear and ſimple view of the quantity of timber to be expected from a gradual improvement of the foreſts, by planting every year no more than that quantity of ground, and re-planting the ſame quantity ſucceſſively, when the trees come to maturity. But it is not neceſſary to proceed ſo ſlowly; nor is that the plan we wiſh to recommend: The Crown has already, by the Acts of 20th Charles the Second, and 9th and 10th William the Third, a power of incloſing 17,000 acres in Dean and New Foreſts only, independent of what ſhall be acquired in thoſe and other Foreſts, on a ſettlement with the commoners; and if the whole quantity to be allotted to the Crown ſhall be ſpeedily incloſed and planted, a much greater, and probably an earlier, advantage may be derived from the improvement. We have already mentioned, that perſons acquainted with the growth of timber differ in opinion as to the length of time in which an oak tree comes to maturity, naming from eighty to one hundred and fifty years; and we think it probable that, if the whole, or the greateſt part of the Crown's allotments were ſpeedily planted, parts would be found, in woods of ſuch vaſt extent, where, from the fertility of the ſoil, the trees might contain, one with another, one load each in eighty years; and as oak trees, protected from injury, ſeldom begin to decay before they have ſtood a much longer time, probably not in leſs than two hundred years, by cutting one hundredth part every year after eighty years, the medium age of felling would be one hundred and thirty years; and it may not be unreaſonable to expect, if this plan ſhould be followed, that the trees would contain a load and a half each, on an average, at the time of felling; in which caſe the 700 acres to be cut annually would produce, one year with another, 50,000 loads; and the value of that quantity would be £.175,000; eſtimating the timber at £.3 10*s*. per load, ſquare meaſure, including the bark and offal wood, which, from the prices they now bear, and the advantageous ſituation of the largeſt foreſts for water carriage to the dock yards, we do not think beyond the value.

Nor is this the only advantage which would ariſe from the foreſts under a proper ſyſtem of management: The underwood and young trees, as well as the great timber, are the property of the Crown in all the foreſts, except in Whittlewood and Salcey, where the underwood belongs to the Duke of Grafton; and in the part of Rockingham Foreſt, where the timber belongs to the Crown, the underwood of which belongs to the Earl of Weſtmoreland; and from the eſtimates of our ſurveyors, we apprehend, that an annual produce of 5*s*. per acre is not more than may reaſonably be expected from periodical cuttings of the young trees and underwood.

The value, therefore, of the whole annual produce, in great timber, underwood, and young trees, would probably come to be worth £.190,000 per annum, without reckoning any-thing for the produce of ſuch land as may not be fit for the growth of oak.

According to offers which have been made, by men of character and ſubſtance, the expence of incloſing the whole quantity by contract, would be only 6*s.* per acre; amounting, for 70,000 acres, (APPENDIX, No. 6), to - - - £.21,000

And the expence of planting the ſame quantity of ground with acorns, 5*s.* per acre - - - 17,500

£.38,500

the whole of which ſum would, as we have ſhewn in former Reports, be derived from the foreſts themſelves by the ſale of trees now growing in them, not fit, and which never would become fit, for the Navy; from which a ſum of 50 or £.60,000 might be raiſed in three or four years; and the removal of thoſe trees is a neceſſary ſtep to the making of new plantations, as no young trees would grow under their ſhade.

The benefits to be expected from the propoſed improvement of the foreſts, we know, cannot be raiſed to the full value at which we have eſtimated them, until the oaks come to be fit for naval uſe; but the whole of the advantages are by no means ſo remote. The quantity of the timber which has been furniſhed from all the foreſts during the preſent reign, has not exceeded 2,000 loads a year, ſquare meaſure; but ſo ſoon as a ſettlement ſhall have been made with the commoners, or other effectual means taken for increaſing the ſtock of timber, we have no doubt that the annual fall in the foreſts may be raiſed to near 4,000 loads ſquare meaſure, and be continued at that rate, without intermiſſion, until the new plantations ſhall be arrived at maturity. Eſtimating the timber, therefore, at £.3 10*s.* per load, including the bark and offal wood, an immediate income of at leaſt £.14,000 per annum would ariſe from the timber trees only, without endangering the continuance of that ſupply; and the advantages to be derived from the underwood, and the thinnings of the young trees, would alſo commence very ſoon, there being already a conſiderable quantity of underwood in ſome of the foreſts, which, in their preſent ſtate, could not with propriety be cut, as that would remove the protection which it now affords to the young trees againſt the deer and cattle; but which might very properly be cut if the woods were incloſed.

PART V.

Of various Means of leſſening Waſte in the Conſumption of Naval Timber, and providing Subſtitutes, in caſe of a Scarcity of Oak.

IN the preceding Parts of this Report we have ſhewn, that if the plans we have recommended ſhall be carried into full effect, the ſupply of timber finally to be expected from the improvement of thoſe foreſts which have been under our inquiry, will probably be ſufficient for the ſupport of the Royal Navy, even though the conſumption ſhall continue to be as great as it has been during the preſent reign.

But as this is only to be looked for after a conſiderable ſpace of time, we have thought it not unneceſſary, nor foreign to the object of our appointment (though, perhaps, ſtrictly ſpeaking, not a part of our duty) to advert to the nature of the conſumption of the timber; and to conſider whether any means could be deviſed to prevent waſte in the preſent expenditure, ſo as to render the ſupply in the mean time leſs inadequate to the demand.

The Commiſſioners of the Navy (Appendix, No. 7.) in anſwer to our inquiries concerning the duration of ſhips of war, give, as their opinion, that ſhips built in the dock yards laſt, on an average, about fifteen years; and thoſe built by contract, in the merchants yards, about ten years. This difference they impute, among other cauſes, to the timber uſed in the dock yards being better ſeaſoned, and the ſhips a longer time in building; which laſt circumſtance alone contributes greatly to their duration. The merchant builders being employed to build ſhips of war only in caſes of emergency, are often, from the urgency of the ſervice, preſſed by the Navy Board to complete them in a ſhorter time than is ſpecified in the contract; and not having a ſufficient ſtock of timber on hand, they are obliged, at a ſhort notice, to provide what is wanted, and to work it up before the juices are ſufficiently exhauſted to render it fit for uſe.

If this opinion of the Commiſſioners of the Navy be well founded (and no perſons can have better opportunities of judging of this matter) it follows, that as the tonnage of the ſhips built by contract, or purchaſed during the preſent reign, amounts to 256,656 tons, and of thoſe built in the dock yards, to only 131,852 tons, the medium duration of the ſhips which compoſe the preſent Navy, taken one with another, is only about eleven years and three quarters.

Every addition to the duration of ſhips being obviouſly a proportional ſaving of timber, if means could be deviſed to make ſhips of war laſt eighteen years, one third part of the preſent conſumption of the timber for the Navy would be ſaved; and inſtead of 50,000 loads being neceſſary for the annual ſupply, 33,333 loads would be ſufficient.

But it is not the value of the timber only which would be ſaved, by making ſhips laſt longer; the workmanſhip, and all other materials, as well as timber, would alſo be ſaved.

It is at preſent the common practice to fell oak timber in the ſpring, for the ſake of the bark, which can only be ſtripped off during the riſing of the ſap. It is, however, a general opinion now, and was alſo in ancient times, that timber felled at that ſeaſon is not in the beſt condition for ſervice; and that oak felled in the winter is more ſolid and durable. The bark of winter-felled timber being loſt, the Commiſſioners of the Navy allow for ſuch timber an advanced price of ſeven and one-fourth per cent. to compenſate that diſadvantage; but bark having riſen very much in value, no great quantity of winter-felled timber is obtained.

Some experiments have been made by the Navy-Board, of the effect of felling timber in winter; and the Montagu, of ſeventy-four guns, was built of it in 1779; but that ſhip not having come under ſuch a repair as required a complete examination of her condition, the Commiſſioners of the Navy ſay (APPENDIX, No. 7.), they cannot yet ſpeak with certainty of the effect.

Inſtead of either of thoſe practices, it is ſtrongly recommended, by writers of great eminence, to ſtrip oak trees of their bark in the ſpring, and not to fell them during the ſame ſummer, but to let them remain to ſeaſon or dry ſtanding.

An account of this practice, which formerly prevailed very generally in Staffordſhire, and ſome adjacent counties, and is ſtill in uſe there, was written in the year 1687, by Dr. Plott, for the ſatisfaction of James the Second, by whoſe command it was recommended to the conſideration of the Navy-Board, by Mr. Pepys, then Secretary of the Admiralty. As this paper, recommended by ſuch authority, and written by a perſon of much knowledge, has never, that we know of, been printed, and as it contains alſo an account of all that is known of the opinions of the ancients concerning the proper ſeaſon for felling trees, we have thought it right to annex a copy of it to this Report. (APPENDIX, No. 8.)

In order that the effect ſaid to ariſe from this practice may be perfectly underſtood, it may not, perhaps, be unneceſſary to obſerve, that trees, in growing, form every year a new circle of wood, between that of the preceding year's growth and the bark. Each circle is, therefore, a year older than the one immediately within it; and in a tree of one hundred years growth, the timber in the center is one hundred years old, and that next the bark is only one year old.

The timber at the heart, in a thriving tree, is, by many experiments, proved to be the hardeſt, the heavieſt, and the ſtrongeſt. Its ſtrength leſſens in proportion to its diſtance from the centre; and a conſiderable part, neareſt the bark, is too young, and too full of juices, to be fit for uſe in ſhip-building. This part, which is called the ſap, varies in thickneſs according to the kind of the oak, the quickneſs of its growth, the age of the tree, and nature of the ſoil. On fertile ſoils, thriving oaks of the beſt kind (which are ſaid to be thoſe which bear acorns of a large ſize, growing ſingly, or in pairs *) have commonly not more than from twelve to fifteen of thoſe annual circles within the ſap; but in oaks of a worſe kind (which are diſtinguiſhed by a browner bark, and ſmall acorns growing in cluſters) and eſpecially in unfavourable ſoils, there are from twenty to twenty-ſix.

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* *Note* Buffon and Du Hamel ſay, that having compared the timber of the oak bearing large acorns with that of the oak bearing the ſmall, in a number of trees of the ſame age, and from twenty-five to one hundred years growth, they found that the firſt had always more heart and leſs ſap. If the one had one inch of ſap to eight inches of heart, the other would have two inches of ſap to ſeven of heart; and ſo in proportion in trees of all ſizes: That they could not, therefore, ſufficiently recommend the planting of that fine kind of oak, which has the great advantages of a quicker growth, and of the timber being ſtronger, more elaſtic, and leſs apt to ſplinter, than the other. The holes made by ſhot in timber of this kind, contracting one third more than in the other, are much more eaſily filled up. In general, they add, the quicker an oak grows, the more heart is found in the timber, and the better it is for uſe.—The texture of the wood is cloſer; there are fewer knots, and fewer of thoſe diviſions which ſeparate the annual circles of wood, and which are more open and porous than the reſt of the wood. Suppl. Vol. II.

The whole of this ſap is always cut off in ſiding the tree, and moulding or converting it into the forms to which it is adapted in ſhip-building: but the ſtripping the tree of its bark, and allowing it to ſtand in that ſtate three years, to ſeaſon, before felling it, is ſaid to have the ſame effect in converting the ſap into uſeful timber, as the allowing the tree to ſtand with the bark on from twelve to twenty-ſix years longer would have. If this ſhall be confirmed by experience, it will be attended with very beneficial and very important effects. Trees of ſixty years growth will be as fit for the Navy, and have as much uſeful timber in them, as trees of ſeventy-two to eighty-ſix years growth, felled in the common way, with the bark on. The great diſcouragement to the planting of oak, ariſing from the lateneſs of the return, will be leſſened; a ſmaller extent of ground will, from the falls of timber being made at ſhorter periods, produce the quantity required for the ſupply of the Navy; and a remedy for the ſcarcity which there ſeems reaſon to apprehend may be ſooner obtained.

Dr. Plott ſays, “ It is found by long experience, that the trunk or “ body of the trees, when barked in the ſpring, and left ſtanding naked “ all the ſummer, expoſed to the ſun and wind, are ſo dried and hardened, that the ſappy part, in a manner, becomes as firm and durable “ as the heart itſelf.”

This is confirmed by Monſieur Buffon, who, in 1738, preſented to the Royal Academy of Sciences, at Paris, a Memoir, intitled, “ An eaſy “ Method of increaſing the Solidity, Strength, and Duration of Timber;” for which purpoſe he obſerves, “ Nothing more is neceſſary than to ſtrip “ the tree entirely of its bark during the ſeaſon of the riſing of the ſap, “ and to leave it to dry completely before it be cut down.”

By many experiments, particularly deſcribed in that Eſſay, it appears that the tree ſhould not be felled till the third year after it has been ſtripped of the bark; that it is then perfectly dry, and the ſap become almoſt as ſtrong as the reſt of the timber, and ſtronger than the heart of any other oak tree, which has not been ſo ſtripped; and the whole of the timber ſtronger, heavier, and harder; from which he thinks it fair to conclude, that it is alſo more durable. It would no longer,” he adds, “ be neceſſary, if this method were practiſed, to cut off the “ ſap; the whole of the tree might be uſed as timber; one of forty “ years growth would ſerve all the purpoſes for which one of ſixty years “ is now required; and this practice would have the double advantage, “ of increaſing the *quantity*, as well as the ſtrength and ſolidity of the “ timber.”

Du Hamel gives a very minute account of many experiments made by himſelf, for aſcertaining the effect of barking trees in this mode; the reſult of which was the ſame: And Dr. Hunter, in his Notes on Evelyn, ſays, “ that by ſtripping off the bark, and allowing the tree to ſtand “ and die before it is cut, the ſappy part becomes as hard and firm as the “ heart.”

If theſe authorities are to be relied on, a practice from which ſuch important advantages may be derived ſhould be immediately adopted, at leaſt with reſpect to timber felled for the Navy, in thoſe foreſts in which the timber and wood are the entire property of the Crown.

It may be thought extraordinary, that if it was found to have ſuch beneficial effects, the practice ſhould not have become more general.

This may, perhaps, be owing, partly to the damage, which, in coppices, muſt unavoidably be done, in either ſtripping the trees three years before, or felling them three years after the time of cutting the underwood; and, partly, to the additional labour and expence of ſtripping trees ſtanding; though this, probably, is not conſiderable; for Buffon ſays, that the bark coming off with more eaſe while the tree is growing, than after it is felled, one man can, in two hours, ſtrip a great tree completely; and, according to the information we have received, the expence is only one-third more than of ſtripping the tree after being felled.

But theſe diſadvantages would not occur in the foreſts, if the plan we have propoſed ſhall be adopted, becauſe the timber being the great object of attention, ſo many trees ſhould be allowed to ſtand, that the underwood muſt become of little or no value, even before the trees are arrived at their full ſize.

It muſt ſeem ſurprizing that, in this country, in which the Navy is an object of ſo great importance, no complete trial has ever been made of the effect of a method of increaſing the duration of timber, ſo eaſily practicable, ſo important in its conſequences, and recommended by ſuch reſpectable authorities.

Such information as we have been able to obtain, of trials which have been made, ſeems to be in favour of the practice; but they appear by no means to have been ſo complete in themſelves, nor is the account of them ſo well authenticated, as to be at all deciſive of the effect; and we have even lately heard that ſome trials have been made in this country, where the reſult is ſaid to have been different, with reſpect to the ſap of the tree, which, it is ſaid, was found to decay as ſoon as the ſap of trees ſtripped after felling; but of thoſe trials we have not yet obtained ſuch certain information as to enable us to ſtate the circumſtances in this Report.

The ſhip called the Royal Sovereign was built very ſlowly, in 1635, 6, and 7. (APPENDIX, No. 8.) The timber grew in the northern part of England, where this practice prevailed, and is ſuppoſed by Mr. Pepys to have been ſtripped of its bark, and winter-felled; and Dr. Plott ſays, that at the time he wrote, which was fifty years afterwards, in the reign of James the Second, the timbers were ſtill ſound, and ſo hard that a nail could hardly be driven into them.

The Commiſſioners of the Navy, in 1687, were informed by Mr. Pepys, that the King would be well content that a trial ſhould be made in the Royal Foreſts of the efficacy of the propoſal of Dr. Plott; and in their anſwer to Mr. Pepys, they ſay, that if the method uſed in Staffordſhire, and other northern counties, of barking the trees in the ſpring, and felling them the enſuing winter, after they have ſtood hardening all the ſummer, could be introduced and put in practice in the ſouthern parts of the kingdom, it would be very much for his Majeſty's ſervice

(APPENDIX, No. 9, C.) ; but how to have it done any where but in his Majeſty's foreſts and parks, they humbly leave for conſideration ; and in a ſubſequent letter to Mr. Pepys, they give their opinion in what manner a trial of this method of treating the trees ſhould be made in Buſhy Park. No farther correſpondence on the ſubject, as we are informed by the Navy-Board, is to be found in their books ; and they conclude, that upon the abdication of James the Second, which took place in the enſuing year, the matter was dropped, and no experiment whatever made of the timber felled for that purpoſe.

In anſwer to our inquiries concerning the probable cauſes of the very long duration of the Royal William, which was launched in 1719, never repaired till 1757, and was ſurveyed afloat in 1785, they inform us, that they cannot trace whether that ſhip had been built of timber ſtripped before felling (APPENDIX, No. 9, B.) ; but that ſhe was five years in building : and it appears from a Report of the Officers of Portſmouth Yard, that the thick-ſtuff and plank had been *burnt* inſtead of being *kilned* ; and alſo that the ends of the beams, the faying parts of the breaſt-hooks, crutches, reſters, knees, &c. had been gouged, in a manner then practiſed, which was called *ſnail creeping* ; by means of which the air was conveyed to the different parts of the ſhip, which they apprehend was very uſeful to her preſervation. (APPENDIX, No. 9, D.)

The extraordinary duration of this ſhip from the year 1719, obviouſly ſuggeſts the propriety of further trials of the methods uſed when ſhe was conſtructed.

The ſhip Achilles, of 60 guns, built at Harwich in 1757, appears by the examination of Mr. Barnard, before the Committee of the Houſe of Commons, in 1771, to have been built by him of timber which had been ſtripped of its bark in the ſpring, and not felled till the ſucceeding winter. Tho' that was not a ſufficient time for the timber to dry, or ſeaſon, according to the opinion of Buffon and Du Hamel, yet when that ſhip underwent a ſmall repair in 1771, the timber, Mr. Barnard ſaid, was found to be very good (APPENDIX, No. 9, E.) ; which is confirmed by a Report of the Officers of Portſmouth Yard ; and ſhe continued in the ſervice until after the peace in 1783, being then twenty-five or twenty-ſix years old.

Some trees in New Foreſt, which were felled about ſeven years ago, had ſtood ſo long without their bark, that the purpoſe for which they had been ſtripped was entirely forgotten, and no information concerning them could be obtained from the office of the Surveyor of the Woods, to whoſe department the matter belonged ; no accounts being kept of the proceedings in that office, to be tranſmitted to ſucceeding Surveyors General. (APPENDIX, No. 10.) Thoſe trees having been ſent to the Dock Yard, and uſed promiſcuouſly with other timber, no uſeful information could be obtained from ſo imperfect an experiment. It deſerves notice, however, that after ſtanding many years without the bark, the timber was found to be perfectly ſound, and fit for uſe.

The Navy-Board, in anſwer to our inquiries on this ſubject, in the month of May 1789, informed us, that “ they had then, ſtanding, ſome trees ſtripped of their bark two years before, in order to try the experiment of building one half of a ſloop of war with that timber, and the

" other half with timber felled and ſtripped in the common way." (APPENDIX, No. 7.) This very judicious mode of making the experiment, if it be properly executed, will undoubtedly go far to aſcertain the effects of this practice.

From the apprehenſion of a want of timber on any ſudden emergency, the Commiſſioners of the Navy have judged it neceſſary to have a quantity in ſtore in the dock yards, equal to the conſumption of three years. This may, perhaps, be a prudent caution in the preſent ſtate of our timber; and it may tend to give confidence to the country, that care is not wanting to provide a ſufficient quantity of naval ſtores; but the expence and the waſte attending this practice muſt be very great, not only in the loſs of intereſt of money on the capital employed in keeping ſo great a ſtock of timber, but in the waſte of the timber itſelf.

The greateſt part of the timber is brought to the dock yards in its rough ſtate, where it is laid up in great piles: The timber of each year's fall is kept by itſelf, that the firſt brought into the dock yard may be the firſt uſed.

The part called the ſap, being full of juices, ſoon begins to corrupt; and that corruption ſpreads, not only to the reſt of the ſame tree, but to thoſe lying next to it. To prevent this waſte, very proper orders have been given by the Navy-Board, " that if there be otherwiſe room, there ſhall not be more than three heights or ranges of great timber;" but from a want of room thoſe regulations, neceſſary for the free admiſſion of air, cannot always be followed; and ſo much is the timber injured from this cauſe, that a very conſiderable part of it is rendered unfit for ſhipbuilding. The proportion cannot be exactly aſcertained; but Mr. Snodgraſs is of opinion, that the waſte of timber kept in ſuch piles for three years, muſt be one third part, or more. (APPENDIX, No. 5.)

But if the foreſts were improved, and put under a proper courſe of management, many advantages might be derived from having timber there, at all times, ready for the uſe of the Navy. As there could be no ground for the apprehenſion of a want, ſo expenſive a proviſion of rough timber would not be neceſſary. The foreſts would ſerve as ſo many magazines of timber, of all forms, which would remain there, in a ſtate of improvement, until it ſhould be ſtripped of the bark, if that practice ſhould be adopted; and need not be felled until it ſhould be required for uſe. By theſe means the waſte would be prevented, and the extremes of keeping the timber too long, as is now frequently done in the dock yards, or uſing it too ſoon, like the merchant builders, both of which tend to accelerate the decay of the ſhips, might be avoided.

The perquiſite of chips, allowed to the ſhipwrights in the dock yards, is another ſource of waſte of uſeful timber, which ought certainly to be prevented.

Under this denomination of chips, each workman carries home, daily, a burthen of pieces of timber, cut off in forming and moulding the different parts of the ſhip. In a letter from the Navy Board to the Lords of the Admiralty, they ſay, that the cuſtom has been for the men to leave off work perhaps an hour before bell-ringing, to cut up uſeful pieces of timber, to complete their bundles; that theſe are often ſold for one ſhilling each, and probably coſt the public three times as much. (APPENDIX, No. 11.)

It appears from the Journals of the Houſe of Commons, that this matter was under the conſideration of Parliament during the adminiſtration of Cromwell; and it was then ſettled, that an addition ſhould be made to the wages in lieu of all chips and former perquiſites whatſoever.

In ſucceeding times, however, of leſs vigilance, this waſteful practice was renewed, and, in ſpite of many attempts to put an end to it, ſtill continues.

At the cloſe of the laſt war, the Navy-Board, in order to leſſen this abuſe, and prepare the way for a remedy, formed many uſeful regulations, which they ordered to be ſtrictly obſerved in each dock yard; and in conſequence of thoſe regulations propoſals were made by the artificers in the yard at Plymouth, to give up the privilege of chips for five-pence per day to ſhip wrights and ſhip carpenters. The Navy-Board laid thoſe offers before the Admiralty, and earneſtly recommended that the matter ſhould be inquired into, and that a ſettlement on that footing ſhould take place. "By ſeizing this opportunity," (they obſerved in the Letter before referred to) "the Public will have "the full advantage of the common working hours; incredible quan"tities of uſeful timber will be preſerved from waſte; no copper nails, "or other valuable ſtores, will be ſecreted, or carried off in the bundles, "the undue advantage ariſing from which is too apt to introduce a ſpirit "of extravagance among the people, very hurtful to the public "ſervice."

We are ſorry, however, to add, that notwithſtanding this repreſentation, nothing effectual was done. After what we have ſo fully ſtated from the letters of the Office which has the ſuperintendance of the dock yards, no reaſoning of ours can be neceſſary to ſhew that an end ſhould ſpeedily be put to this waſteful practice. Having, however, in the courſe of our inquiries, ſeen many examples where an increaſe of wages has been given in lieu of perquiſites, but where the perquiſites have been, after a ſhort time, reſumed, and the wages, meant as a compenſation, have proved in the end only an additional loſs to the Public, we cannot too ſtrongly recommend that this may not happen in the caſe now under conſideration; and for this purpoſe, nothing ſeems to us more likely to be effectual, than what is ſuggeſted in the ſame letter from the Navy Board, that "the additional wages ſhould be granted as an *extra* "ſum, always to be entered ſeparately on the pay books, as in lieu of "chips." And we would add, that the chips ſhould every day be collected into heaps, by labourers employed for that purpoſe, and ſold by public auction, at a particular time fixed, once in every week, from which a fund might ariſe to defray a part, at leaſt, of the expence of the additional wages.

The expence of the carriage of timber from the foreſts to the dock yards forms a very conſiderable part of its ultimate coſt to the public, except in what is brought from New Foreſt, which is ſituated ſo near to Portſmouth, that the whole charge of land and water carriage is only fifteen ſhillings and three halfpence per load. The expence of carriage from the other foreſts is as follows:

		£.	s.	d.
From	Aliceholt - - -	1	8	0
	Dean - - -	2	10	0
	Whichwood - -	1	5	0
	Whirtlewood, by way of Oxford	3	12	0
	and by Hertford - -	3	15	0
	Salcey - - -	3	18	0
	Bere - - -	0	8	6

and from Waltham Foreſt ſomewhat leſs than from Bere.

We have already mentioned, that by ſiding and converting the timber, one half, or more, is cut off, and not uſed for the purpoſes of ſhip building; conſequently, by ſquaring and moulding in the foreſts, one-half of the expence of carriage would be ſaved on all the timber, except that from New Foreſt; and we are informed that this may be done with great advantage in the foreſts, under the direction of proper perſons from the dock yards. (Appendix, No. 5.)

The Commiſſioners of the Navy have, with great propriety, already adopted the plan of ſiding the timber in the foreſts of Whittlewood and Salcey, from which the expence of carriage is the higheſt; and we are humbly of opinion, that if the foreſts were improved, a very great ſaving to the public would ariſe from adopting this practice in all of them except New Foreſt, Bere, and Waltham. There are ſome uſes to which a part of the timber cut off in the converſion is applied in the dock yards; the reſt is commonly ſold, in lots, by auction; but we apprehend there cannot be ſuch ſuperior advantage from ſelling in the dock yards what is not uſed there, inſtead of ſelling it in the foreſts, as to make up for the expence of the carriage from any of the more diſtant foreſts.

The Commiſſioners of the Navy ſay, in anſwer to our inquiries, "that letting the ſhips ſtand in frame a ſufficient time for ſeaſoning "the ſeveral parts, during the building, and the late introduction of "fire ſtoves to air the ſhips building, and thoſe lying up in ordinary, "contribute greatly to their duration; that if ſhips were built under "cover, and roofs over them while they remain in the ſlips, it would "be a means of rendering them ſtill more laſting; and that the value "ſaved by theſe methods, they think would far exceed the expence of "putting them in practice. (Appendix, No. 7.)

Theſe opinions are confirmed by thoſe of Mr. Snodgraſs, and of the moſt eminent merchant builders. (Appendix, No. 4, 5.)

In Venice, ſhips have for a long courſe of time been built and preſerved under cover. That practice has been introduced alſo in Sweden; and is mentioned with approbation by Monſieur Neckar, in his Treatiſe on the Finances of France.

By ſtripping and felling, in the manner we have recommended, a ſufficient quantity of timber in the foreſts, to keep up the naval force deemed neceſſary for this country in time of war, the miſchiefs occaſioned by building with green or unſeaſoned timber, which not only renders the ſhips leſs durable, but is extremely prejudicial to the health of the ſeamen, would be prevented.

It appears from the anſwers of Mr. Snodgraſs, that in the ſhips built for the Eaſt India Company, iron knees have for many years been uſed inſtead of oak, and are found to anſwer better than oak, being lighter, cheaper, and ſtronger. They have alſo been adopted in the conſtruction of ſhips of war in France for a great while paſt; and it ſeems extraordinary that, notwithſtanding the apprehenſions of a ſcarcity of oak timber in this country, and though the difficulty of procuring knees has been ſuch as to induce the Navy Board to make trial of cheſnut and aſh, yet iron has been very little uſed in the conſtruction of our's. It would undoubtedly prove a great ſaving of timber, and of that kind which it is already moſt difficult to procure; and in which, by the grubbing of hedge rows, in conſequence of the extenſion of tillage, and improvements in agriculture, a ſtill further decreaſe is ſpeedily to be apprehended. This is, therefore, a very important ſuggeſtion; and, being founded on experience, well deſerves conſideration.

In the anſwers of Mr. Snodgraſs in particular, and in thoſe alſo of the merchant builders whoſe opinions we have obtained on the means of preventing waſte, and increaſing the duration of ſhips, many alterations, beſides thoſe which we have mentioned, are ſuggeſted, as improvements in the form and conſtruction of ſhips. Our view, in the inquiries we have made of perſons in that profeſſion, has been to diſcover whether any alteration in the preſent practice would be likely to contribute to the ſaving of timber, by rendering ſhips more laſting; and whatever appeared to us to have that tendency, being connected with the object of our appointment, is inſerted in this Report: But we have not here detailed the other improvements which have been ſuggeſted, in the form and mechaniſm of ſhips, not from thinking them of little importance, but becauſe they are matters which do not fall within the limits of our duty. They, however, appear to us to be ſo well deſerving of the conſideration of thoſe whoſe province it is to ſeek for improvements in naval architecture, that we have inſerted them at length in the APPENDIX, and annexed a Section, drawn by Mr. Snodgraſs, (APPENDIX, No. 4, 5.) of a 74 gun ſhip and a frigate, as built in his Majeſty's dock yards, and another upon a plan recommended by him, not thinking it right, in a matter of ſo much importance to this country, to keep back alterations ſuggeſted by very intelligent men, poſſeſſed of great profeſſional ſkill and long experience.

We cannot, indeed, help remarking, that though this nation excels all others in extent of commerce, and in naval power, and though there have been great improvements in every other art, yet hardly any of thoſe lately made on the conſtruction of ſhips have originated in our dock yards, but have generally been copied from ſhips taken in war.— It would ſeem as if ſome public encouragement were wanting for inventions in this moſt important art. Perhaps this defect may in ſome degree be ſupplied by the late eſtabliſhment of a NAVAL SOCIETY, inſtituted for this purpoſe; and as there are many men of genius and practical knowledge members of it, it is to be hoped that this reproach will not long continue.

But though a great ſaving in the conſumption of oak timber might undoubtedly be made by the means we have pointed out, and the Royal Foreſts probably may, under a proper management, come to produce a ſufficient quantity for the ſupply of the Navy, it remains ſtill an object well deſerving the attention of Government, to diſcover ſome other kind of tree which may be expected to anſwer inſtead of oak, at leaſt in the conſtruction of trading ſhips, and which will grow to ſufficient ſize on ſoil not fit for tillage. Such appears to be the rapid advancement of the commerce and population of this country, that not only all the land at preſent in cultivation is already found inſufficient to produce food for the inhabitants; but, if the preſent proſperity ſhall continue, all that is capable of culture muſt, at no very diſtant time, be required for that purpoſe. The ſoil fitteſt for oak is the beſt alſo for wheat; and the woods of oak cannot be increaſed, without encroaching on the ſoil neceſſary, or which may ſoon become neceſſary, for the ſubſiſtence of the people. It appears to us, therefore, adviſeable, that the Britiſh Conſuls and Governors ſhould be inſtructed to procure ſeeds of all trees which fall within that deſcription, and of all ſuch as are uſed in the conſtruction of ſhips in foreign countries.

We obſerved in a former Report, that the larch, or larix, was by far the moſt likely to anſwer this purpoſe, of any kind of tree of which we had obtained any certain information; and we ſhall annex to this Report a copy of a letter (APPENDIX, No. 11.) from Mr. Yeams, late principal ſhip-builder to the Empreſs of Ruſſia at Peterſburgh, communicated to us by Mr. Thomas Mitchell, late firſt aſſiſtant to the Surveyor of the navy, in which he ſays, that “at Archangel the Crown ſhips are built of larch, a wood rather preferable to oak in point of duration, but in reſpect of moulding ſtuff the ſame as the oak.” We have other information to the ſame effect; but the Empreſs is ſaid to be anxious to prevent the exportation of the ſeed of this tree, or the timber itſelf, which is kept entirely for the uſe of her Navy; and one Gentleman, who is connected with Ruſſia, and who has given us the information we requeſted concerning that tree, has, at the ſame time, deſired his name to be concealed.

In an account of the Arſenal at Venice (APPENDIX, No. 13.), given by John Strange, Eſq. the late Miniſter to that State, it is ſaid, “that the bottoms of the ſhips of war are ſheathed with larch, which makes an excellent ſtrong ſheathing.”

Many circumſtances are mentioned by Evelyn, to ſhew that the larch in former times was very generally uſed, where laſting and ſubſtantial timber was required, or where it was to be ſometimes under water and ſometimes dry. “A ſhip found in the Numidian ſeas, which had been 1,400 years under water, conſiſted of larch and cypreſs. The bridge to his Naumachia was built of it, and various other bridges, by Tiberius. Vitruvius regrets that they had not more of that uſeful timber, and ſays, it will hardly burn [*]. It was uſed in ſhip-build-

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[*] Et robuſta larix, igni impenetrabile lignum.

“ ing at Venice and at Naples, and ſeems to excel for beams, doors, “ and maſts of ſhips. It reſiſts the worm, and being driven into the “ ground it becomes almoſt petrified, and will ſupport an incredible “ weight. It makes everlaſting ſpouts, penthouſes and featheredge, “ which need neither pitch nor painting to preſerve them; and alſo ex- “ cellent pales, poſts, rails, pediments, and props for vines; and in “ Switzerland (Dr. Hunter adds) they cover the roofs of their houſes “ with ſhingles of larch, and that it is remarked, that thoſe trees which “ have been planted in the worſt ſoils and moſt expoſed ſituations have “ thriven the beſt.”

The larch is well known to grow very faſt, notwithſtanding its ſtrength and hardneſs. The ſeed was brought to this country from the Alps, where it grows higher up in the mountains than any other tree. It is the natural produce of Ruſſia, a climate colder than ours; and it grows luxuriantly in the moſt northern and mountainous parts of this country. We have before obſerved, that we do not mean to recommend that the larch timber ſhould be uſed in building ſhips of war in this country, while oak can be had. The Ruſſian oak, to which it is preferred, is much inferior to the Britiſh. Indeed there is no foreign timber produced in any of the Northern parts of Europe, or which can be brought to this country without very great expence, which is nearly equal in quality to what grows in this iſland. We only mean that the larch is the beſt ſubſtitute for oak that we have heard of, if the ſcarcity ſhould become ſo great, as that our dock yards cannot be ſupplied with Britiſh oak, and perhaps equal to any foreign oak produced in the north of Europe.

Its hardneſs, ſtrength, and durability, may, perhaps, all be increaſed, by the means of ſtripping off the bark, which has ſuch beneficial effects on the oak. Buffon ſays, that “ he cauſed pines, firs, and other ſpecies “ of evergreens, to be barked ſtanding; and as he found them live “ longer after being ſtripped of their bark, than oaks on which the “ ſame operation had been performed, ſo their wood acquired, propor- “ tionably, greater hardneſs, ſtrength, and ſolidity. It would therefore,” he adds, “ be very uſeful to bark ſtanding ſuch fir trees as are de- “ ſtined for ſhips maſts, and to let them ſtand two, three, or four years “ to dry, whereby they would acquire a degree of ſtrength and hardneſs “ much greater than in their natural ſtate.”

There are many parts in the foreſts, particularly New Foreſt and Woolmer, where the ſoil is not of a quality fit for the growth of oak, in which the larch, the fir, and the pine might be planted with great advantage; and as the larch is of far quicker growth than the oak, it may become very uſeful, if the ſupply of oak timber in this country ſhould fail before the plantations which may be made in conſequence of the plans we have ſuggeſted ſhall come to maturity.

Before we conclude this Report, we cannot avoid mentioning, among the cauſes of the ſcarcity of timber, the high price of coal, which undoubtedly tends to increaſe the conſumption of wood for fuel, as well as the burning of turf; for though it is not large timber which is conſumed in that way, but underwood, and the branches of trees, yet the additional demand for underwood renders it more valuable, and the growth of great trees, by which it is injured, is the more diſcouraged. The inducement to the waſteful practice of lopping trees is by the ſame means increaſed; and the rights which the neighbouring inhabitants have in many inſtances acquired to be ſupplied with firebote and turbary from the foreſts, are rendered ſomewhat more valuable, and leſs eaſy to be redeemed.

The quantity of ground employed in the produce of underwood for fuel cannot, without an actual ſurvey, be aſcertained. A common cottager's family, according to the information we have received, will, in a year, conſume from a quarter to half an acre of underwood of twenty years growth; and, if this be true, from five to ten acres of ground muſt be required for the conſtant ſupply of ſuch a family with fuel.

This is as much ground as would be neceſſary to produce, in oats or wheat, food for at leaſt two families, or in potatoes for ſix families. It is true, that, in conſequence of the improvement of roads, and increaſe of inland navigation, the uſe of coal has, of late, become more general than it formerly was; yet as wood and turf are ſtill commonly uſed in many parts of England, the whole quantity of land employed in furniſhing thoſe kinds of fuel muſt be very conſiderable; and in this country where all the land hitherto cultivated is found to be inſufficient for the produce of corn for the ſuſtenance of the inhabitants, and where there is ſo much danger of a ſcarcity of timber, it cannot but be lamented, that any conſiderable part of the ſoil ſhould be ſo employed, while there is, under the ſurface, an inexhauſtible ſtore of fuel of a much better kind.

The duty on coal adds to this evil, by increaſing the price, and conſequently the inducement to burn wood; and it is unfortunate that the public exigencies ſhould have required that ſupply. This would naturally lead to an extenſive and important field of inquiry, concerning the effect of that tax on induſtry and population on the one hand, and on the public revenue on the other; but which lies beyond the limits of what is committed to us. What we have ſaid, however, ſeemed neceſſary, that it might not be ſuppoſed we had overlooked the tendency which the high price of coal has to increaſe the ſcarcity of great timber, and that the effects we have pointed out might not eſcape attention, if any alteration or new arrangement concerning that duty ſhould at any time come under the conſideration of the Legiſlature.

We have now given, at conſiderable length, as juſt an idea as we are able, of the progreſſive ſtate of the timber in this country, down to the preſent times. We have given a computation of the conſumption for naval purpoſes, founded on official information; and have ſhewn, as we apprehend, that there has long been a gradual decreaſe in the quantity of timber, and an increaſe in the demand for it. We have endeavoured to point out the cauſes of that decreaſe; and to ſhew that thoſe cauſes muſt remain, while this country continues to proſper. We have given a view alſo of the ſupply which may be expected, and the advantages which may be derived, from the improvement and proper management of the Royal Foreſts; ſuggeſting, at the ſame time, various means which we think ſhould be adopted, to leſſen the danger to be apprehended from a ſcarcity of timber for the ſupport of the Navy.

In the inveſtigation of thoſe ſubjects, and in the concluſions we have formed, we have not allowed ourſelves to be influenced by popular opinions, on the one hand, nor by theoretical arguments of writers, however reſpectable, on the other; but have drawn our information from official documents, and real tranſactions; and have given the greateſt attention to the teſtimony and ſentiments of men, whoſe ſituations or employments enable them to judge from their own experience and obſervation. We have guarded againſt the effect of any miſrepreſentation from thoſe who may, perhaps, be prejudiced, or partial, by the great variety of the ſources from which we have derived our information, by conſulting men whoſe intereſts and objects were different, and whoſe character and ſituation put them above ſuſpicion; and in order that a judgment may be formed how far our concluſions are ſupported, and the meaſures we have propoſed are prudent or neceſſary, we have added the authorities and evidences on which our opinions have been founded.

Land Revenue Office, Scotland
Yard, 6th February 1792.

CHAs. MIDDLETON, (L. S.)
JNO. CALL, (L. S.)
JOHN FORDYCE, (L. S.)

APPENDIX.

No. 1.

ABSTRACT of the Accounts of Woods ſurveyed in Foreſts, Parks, and Chaſes, and upon Manors and Tenements belonging to the Crown, in the Year 1608; and a Computation of the Number of Loads of Timber and Firewood therein compriſed.

		Timber Trees.				Decayed Trees.			
		Number.	Value.			Number.	Value.		
			£.	s.	d.		£.	s.	d.
Foreſts, Parks, and Chaſes,	Exchequer -	566,179	260,847	2	3	455,259	69,496	18	7
	Duchy -	14,014	5,621	3	11	36,032	6,788	9	2
Manors and Tenements	Exchequer -	175,352	47,978	14	4	146,195	14,891	17	4
	Duchy -	29,203	10,493	1	—	44,572	5,297	5	10
	Totals	784,748	324,940	1	6	682,058	96,474	10	11

The number of loads of timber, computed at 10*s.* per load, is 649,880 loads.
The number of loads of decayed trees, computed at 20½ *d.* per load, is - - - - 1,148,660 loads.

No. 2.

Navy-Office, 12th May, 1791.

An ACCOUNT of the Contract Prices paid by the Navy Board for Britiſh Oak Timber, Plank, and Thick-ſtuff.

TIMBER in a rough State.

For Straight of 100 feet meetings, and - - - } £. 4 5 — per Load.
Compaſs of 96 - - - - and } — 3 — per Load.
in addition thereto, in conſideration that no tops are to be received but what are deſcribed in the Contracts.

Straight from 100 to 190 feet - - - } Advances one ſhilling in
Compaſs - 96 - 182 - - - } every five feet.
Straight - 190 - 270 - - - } Advances ſix pence in
Compaſs - 182 - 259 - - - } every five feet.
Straight - 100 - 90 - - - } Falls one ſhilling in every
Compaſs - 96 - 86 - - - } five feet.

Straight

Straight	90 to 80 feet	- - -	Falls two ſhillings in every five feet.
Compaſs	86 - 77	- - -	
Straight	80 - 70	- - -	Falls two ſhillings and ſix pence in every five feet.
Compaſs	77 - 67	- - -	
Compaſs	67 - 53	- - -	Falls three ſhillings in every five feet.

The higheſt Contract Meetings are	ſtraight - -	270 to 230 feet.
	compaſs - -	259 - 220
The loweſt - -	ſtraight - -	70 - 60
	compaſs - -	53 - 45

N. B. Two ſhillings per load advance is given for what is delivered at Sheerneſs yard.

Theſe prices have continued as they are at preſent ever ſince the year 1756, except that in 1772 a reduction was made of two ſhillings per load for Plymouth yard, which till then was the ſame as Sheerneſs now is. For ſuch timber as is winter-felled, a further allowance is made of 7l. 5s. per cent.

PLANK OAK, Engliſh.

4 inch - -	£.7 per load	for all the Yards.
3 - - -	6	

Which have been the prices ever ſince 1769.

THICK-STUFF OAK, Engliſh.

The prices of this article depend upon its meetings, and what uſes it is qualified for.

If for Clamps, it is from -	£.10 0 0	to £.8 1 0 per load.
Spirketting - -	9 5 0	7 11 0
Wales - -	8 10 0	7 1 0

Theſe prices have remained the ſame from the year 1777.

SIDED TIMBER.

The prices of ſided timber likewiſe depend upon its meetings, and upon the parts of a ſhip, as well as the claſs of ſhips, for which, from the nature of its growth, it is adapted. Both the one and the other of theſe particulars are very various; and the prices are from 10l. 10s. to 6l. 4s. per load, between which there are many intermediate prices.

In conſequence of theſe circumſtances it is thought that a copy even of the whole ſcheme of the Sided Contract would not be more ſatisfactory than the above.

The prices have continued the ſame ever ſince 1777.

Mem.—It may be neceſſary to add, that when it appears that the expence to the contractor of the land and water carriage of ſided timber, and of the thick-ſtuff, plank, and knees that are to be delivered on his contract for *ſided* timber, exceeds 1l. 18s. per load, one half of the exceeding is allowed him, provided that half does not exceed 7s. 6d. per load, not more than 7s. 6d. per load being ever allowed.

No. 3.

QUESTIONS propoſed by the Commiſſioners of the Land Revenue, to be anſwered by the Purveyors of His Majeſty's Dock-Yards; with their Anſwers.

QUESTION 1.

Whether the quantity of large oak timber in general, fit for the uſe of the navy, is increaſed or diminiſhed within memory in that part of the kingdom with which you are beſt acquainted? naming the counties.

ANSWERS.

1. By Mr. Thomas Nichols, Purveyor of Portſmouth yard.

Greatly decreaſed in all the woodland counties, but more particularly in Suſſex, Hampſhire, Berkſhire, Kent, Herefordſhire, Glouceſterſhire, Shropſhire, Dorſetſhire, Somerſetſhire, and the Welch counties.

2. By Mr. Thomas Harriſon, Purveyor of Plymouth yard.

Conſiderably diminiſhed in the counties of Devon, Somerſet, Glouceſter, Hereford Worceſter, Salop, Cheſhire, and part of Stafford,

Monmouth, Glamorgan,
Carmarthen, Pembroke, } South Wales.
Brecon, and Radnor,
and Montgomery - North Wales.

3. By Mr. George Evens, Purveyor of Chatham yard.

The oak timber fit for the uſe of the navy is diminiſhed in general, and in thoſe counties that I have been moſtly in, viz. Kent, Suſſex, Eſſex, Norfolk, parts of Northamptonſhire and Yorkſhire.

4. By Mr. John Croſs, Purveyor of Woolwich yard.

The quantity of large oak timber in general, fit for the uſe of the navy, is diminiſhed within memory in the counties of Middleſex, Surrey, Eſſex, Suffolk, and Norfolk, with many more counties.

5 By Mr. Benjamin Slade, Purveyor of Deptford yard.

The counties I have principally been acquainted with are, Berkſhire, Bucks, Northampton, ſome ſmall parts of Hants, Suffolk, and Norfolk; in all of which counties large timber is greatly diminiſhed; and more particularly in every maritime county which lay convenient for water carriage. In the counties of Suffolk and Norfolk, 20 or 30 years ago, many thouſand loads of timber were produced which do not now produce ſo many hundreds; the inland counties of Hertford and Bedford are very near exhauſted of large timber, as being tolerably convenient for the River Thames.

QUESTION 2.

Whether, particularly, the quantity of ſuch timber growing in woods is increaſed or diminiſhed?

ANSWERS.

Mr. Nichols.—Decreaſed.

Mr. Harriſon.—Diminiſhed.

Mr. Evens.—The quantity of oak timber in woods in general is decreaſed in the five years I have been in the employ.

Mr. Croſs.—The quantity of ſuch timber growing in woods is diminiſhed.

Mr. Slade.—See his Anſwer to Queſtion 3.

QUESTION 3.

Whether there is an increaſe or decreaſe of ſuch timber growing in hedge rows?

ANSWERS.

Mr. Nichols.—Decreaſed.

Mr. Harriſon.—Decreaſe.

Mr. Evens.—A very great decreaſe.

Mr. Croſs.—A decreaſe.

Mr. Slade.—In the counties I am acquainted with, the timber has been moſtly in parks or hedges round farms, which when felled is ſeldom re-placed, either by planting or ſaving the acorn. The birds ſometimes drop an acorn, a plant will ſpring up, and if protected by other ſhrubs from the cattle, may grow to maturity. Such timber which is felled in woods, and the root left in the ground, may produce underwood, but ſeldom any more timber of ſize; conſequently timber decreaſes in both inſtances.

QUESTION

QUESTION 4.

Whether the growth of oak timber in hedge rows is generally encouraged, or whether the grubbing up of hedge rows for the enlarging of fields and improving arable ground, is become common in thoſe counties?

ANSWERS.

Mr. Nichols.—Generally encouraged. There are particular inſtances of hedge rows being grubbed up, but it is by no means a common practice.

Mr. Harriſon.—Not encouraged; the grubbing up of hedge rows, for the enlarging of fields and the improving of arable ground, is become common.

Mr. Evens.—The growth of oak timber in hedge rows is diſcouraged for the enlarging of fields and improving of arable lands; and in ſome ſituations, where the hedge rows are not grubbed up, the trees are ſo lopped as to render them generally defective when of full growth, and the hedge rows in great part of the county of Norfolk are oak pollards.

Mr. Croſs—The growth of oak timber in hedge rows is in ſome places encouraged, in others grubbed up for enlarging of fields and improving of arable ground, but not in general.

Mr. Slade.—Every gentleman who has a timbered eſtate will do all he can to protect it from depredation, either by cutting off the heads or limbs, which is certain deſtruction. The tenant too frequently does it, if the branches overſhadow the ground too much; I never knew an inſtance where oak timber has been grubbed up for the purpoſe of enlarging fields, or improving arable ground; when the tree has been felled, the gap has been filled up to prevent cattle from roving.

QUESTION 5.

Whether in ſuch oaken woods as are cut at ſtated periods in ſucceſſion, it is cuſtomary to leave young ſaplings at each cutting? and if ſo, Whether they are generally barked at the ſecond fall, and cut down for country uſes, or preſerved for timber?

ANSWERS.

Mr. Nichols.—In cutting of the underwood at ſtated periods, it is uſual in ſome counties to leave the young oak ſaplings to ſtand for timber, where the ſoil is ſuitable for the growth of it; in others it has been a practice to let them ſtand till a ſecond cutting, and then fell them for country uſes; but this cuſtom is not ſo common as it was ſome years ago, particularly in Herefordſhire, Glouceſterſhire, Shropſhire, and the Welch counties, where this practice moſtly prevailed.

Mr. Harriſon.—Saplings are left at each cutting, but generally barked at the ſecond fall, and cut down for country uſe.

Mr. Evens.—It is the practice in ſome ſuch woods to leave ſaplings at each cutting, and frequently to cut down ſuch ſaplings as were left at the former cutting of the underwood.

Mr. Croſs.—In ſuch oaken woods as are cut at ſtated periods in ſucceſſion, it is cuſtomary to leave young ſaplings at each cutting, and in ſome places (not general) all barked at ſecond or third fall, and cut down for country uſes: in theſe caſes the raiſing oak timber is for ever cut off.

Mr. Slade.—I think there is an Act which obliges every perſon who cuts a coppice to leave a certain number of tillers or ſaplings on a rood, with a view to encourage the growth of timber; and I believe, in ſome meaſure, it is complied with; but on the ſecond cutting, when theſe ſaplings become valuable for uſe, for hop poles, or other purpoſes, and bark, they generally are taken down, and the ſame number of young ſaplings again left, by which means the increaſe of timber is prevented.

QUESTION 6.

Whether the improvement of roads, and the navigable canals made during the laſt thirty years, have not, by reducing the expence of carriage, been the means of bringing large ſupplies of timber to the dock yards which could not otherwiſe have been brought there?

ANSWERS.

Mr. Nichols.—The improvements made in roads, and the navigable canals, have been certainly the means of getting timber to the dock yards from places that were almoſt inacceſſible before.

Mr. Harriſon.—The improvement of roads has certainly been the means of bringing large ſupplies of timber to the dock yards out of the above counties, *but not the canals*.

Mr. Evens.—The improvement of roads and navigable canals have been the means of bringing large ſupplies to the navy dock yards of late years that could not otherwiſe have been brought.

Mr. Croſs.—The improvements of roads and navigable canals made during the laſt thirty years, have reduced the expence of carriage, and been the means of bringing large ſupplies of timber to the dock yards which could not otherwiſe have been brought there (without a very great expence).

Mr. Slade.—Undoubtedly opening the country, by improving the roads and cutting canals, has been the means of bringing timber to hand which otherwiſe would have either periſhed or been made uſe of for country uſes. But the encouragement given by Government to the timber merchant, by allowing a certain proportion of carriage, has enabled them to bring timber from a diſtance which they would never have attempted; at firſt it was of great uſe, when the timber in the diſtant counties was purchaſed much cheaper than it is now. Gentlemen are become better acquainted with the value of timber, as they find it more eaſy to be removed by the country being more acceſſible.

QUESTION 7.

Whether of late years greater quantities of timber have not, in conſequence of this increaſed facility of carriage, been felled in thoſe parts of the country which were before inacceſſible, than they will be able to continue permanently to ſupply?

ANSWERS.

Mr. Nichols.—In conſequence of the improved roads and navigable canals, great quantities of naval timber have been obtained from the inland counties, and the ſtock is now much leſſened; but the younger timber trees and the woodlands in general in thoſe counties are better attended to, as timber is become of more value, and will, I preſume, afford a permanent ſupply, though perhaps not of any great quantities for ſome years, nor adequate to the demand.

Mr. Harriſon.—Yes.

Mr. Evens.—Moſt certainly; and in my opinion they will not be able to continue a permanent ſupply from thoſe woods, as thoſe I have ſeen within the three laſt years, they have ſelled the whole both large and ſmall; and ſome woods are entirely grubbed up.

Mr. Croſs.—Greater quantities of timber, in conſequence of this increaſed facility of carriage, have been felled in theſe parts of the country which were before inacceſſible, but (from the great conſumption of timber) a permanent ſupply cannot poſſibly be expected.

Mr. Slade.—Within 20 or 25 years great quantities of timber have been brought to the dock yards, and are now bringing from the counties of Hereford, Monmouth, Worceſter, Shropſhire and Montgomery, from the improvement of the roads and encouragement given; but I am of opinion large navy timber becomes very ſcarce; and the reaſon is obvious—Some of thoſe counties grow great quantities of cyder, and large timber made uſe of by the coopers for the making veſſels, and great prices given for timber, which not only diminiſhes the timber but takes it out of the hands of the timber merchant, who cannot give the prices of 3s. or 3s. 6d. a foot on the ſpot.

QUESTION 8.

Whether the general conſumption of oak timber, for building or other uſes, *within* thoſe counties, is increaſed or diminiſhed? and, To what cauſe, in your opinion, is ſuch increaſe or decreaſe to be imputed?

ANSWERS.

ANSWERS.

Mr. Nichols.—Greatly decreaſed, in conſequence of being ſupplied with fir timber, by the means of the improved ſtate of the roads and the canals.

Mr. Harriſon.—Diminiſhed: 1ſt, There being many ſmall farms thrown into one, whereas one houſe and appurtenance ſerve, where uſed to be a houſe and appurtenance to each farm.

2d, Leſs quantity of timber in the building of houſes than uſed to be, particularly ſo oak.

3d, Since the improvement of roads and navigable canals made, great quantities of fir timber have been brought into the interior parts of the country, which have leſſened the conſumption of oak timber for houſe-building, &c.

Mr. Evens.—The general conſumption of oak timber in thoſe inland counties is increaſed; the cauſe in ſome meaſure is, that in that part of the country the navigable canals are cut through is become more populous, and an increaſe of buildings: alſo conceive that a greater quantity of young timber is uſed for the locks and boats for the navigation, &c. on ſuch canals.

Mr. Croſs.—The general conſumption of oak timber, for building or other uſes, within theſe counties, is greatly increaſed by the increaſe of the navy, trade in general, and increaſe of ſcantlings in Eaſt India ſhips.

Mr. Slade.—In all inland counties, where fir timber and deals are not to be had without great expence, oak timber is generally made uſe of for building of every deſcription; rooms are laid with oak of the beſt quality; ſtudies fitted. I do not know any conſumption of oak timber greater than coopers ware, particularly in the cyder counties. I have known forty guineas given for a tree of five load; the reaſon it does not increaſe, is want of attention in planting and nurturing the young oaks.

QUESTION 9.

Whether the price of oak timber for carpenters or country uſes is increaſed within the laſt forty years, and in what proportion?

ANSWERS.

Mr. Nichols.—Much the ſame.

Mr. Harriſon.—Increaſed one third.

Mr. Evens.—By what enquiries I have made, find, that for near twenty years paſt the price of carpenters timber, or for other country uſes, has been nearly the ſame.

Mr. Croſs.—The price of oak timber for carpenters or country uſes, is greatly increaſed within theſe laſt forty years, but to what amount am not able to ſay.

Mr. Slade.—As it becomes more ſcarce it increaſes in price. I ſuppoſe, within the time mentioned, it may have done ſo near one fourth (this more from the report of others than from my own obſervation). I am pretty confident that large oak timber fit for the navy is increaſed more than 30 per cent. to the purchaſer.

QUESTION 10.

Whether the improvement of roads, and the navigable canals, have not introduced the uſe of coal in parts of the country in which wood was before generally uſed for fuel? and, Whether in ſuch parts the demand for underwood, and the value of it, have been increaſed or leſſened?

ANSWERS.

Mr. Nichols.—The introduction of coal by the means of the canals has leſſened the conſumption of fuel wood in many places, and lowered the price of it.

Mr. Harriſon.—The improvement of roads, and navigable canals made, have certainly been the means of introducing the uſe of coal into many parts of the country where wood was formerly uſed for fuel; but wood for fuel is not totally exploded. In moſt parts of the country the farmers and cottagers lop the hedge row trees, &c. by which means the beſt formed timber for ſhip-building is very much injured. In ſome of the above-mentioned counties underwood is increaſed in demand and in value, owing to the increaſe of the manufacturing of iron, and the demand for hop poles.

Mr. Evens.—Notwithſtanding coals are more generally introduced, I have found, on different enquiries, that underwood has advanced in price within theſe few years.

Mr. Croſs.—The improvement of roads and the navigable canals have introduced the uſe of coals in parts of the country in which wood was before generally uſed for fuel. In ſuch parts the demand for underwood, and the value of it, rather think is neither increaſed or leſſened. (The improvement of roads, &c. opened other markets, and general riſe of neceſſaries has kept up the price.)

Mr. Slade.—In the counties of Stafford and Worceſter, and others, where the inland parts have been made acceſſible by the canals, and to which coals have been introduced, has leſſened the conſumption of wood for fuel, which is produced from the heads of the trees. Underwood is made uſe of generally for charcoal and ſmall-coal, and conveyed to cities and manufacturing towns which require it. The larger ſort of cordwood is conſumed at the iron works, and bears more or leſs prices, from ſix ſhillings to ten ſhillings or twelve ſhillings per cord on the ſpot, as more or leſs wanted. Where there are many forges I have known it very eagerly inquired after, and fetch a great price. Where coal is to be had cheap for family uſe, I believe cordwood or chips are not in much eſtimation.

QUESTION 11.

Whether, in thoſe parts of the country in which underwood is more valuable in conſequence of a demand for hop poles, or from other cauſes, it has become the practice of late years, more than formerly, to cut down the great timber trees on account of the injury they do to the underwood?

ANSWERS.

Mr. Nichols.—It is a practice in ſome parts of the country, but I believe not ſo much as formerly.

Mr. Harriſon.—Yes, it has.

Mr. Evens.—In ſome parts of the Weald of Kent and Suſſex there is a ſucceſſion of timber trees left in thoſe woods; but in the higher lands of Kent the growing timber trees have been taken down of late years more than formerly, as injurious to the underwood, and generally managed as per Anſwer to Queſtion the 5th.

Mr. Croſs.—In thoſe parts of the country in which underwood is more valuable, it has become the practice of late years more than formerly to cut the great timber trees, on account of the injury they do to the underwood.

Mr. Slade. I never knew an inſtance of it; and I ſhould eſteem a perſon deprived of reaſon to do ſo. I have often ſeen very fine oak timber in coppices which has been very thick of underwood, and which has been improving. When oak trees are young, I am of opinion the underwood growing round them is a protection, and draws them up to a height. It is from places of this ſort, and from woods, all the plank and thick-ſtuff is produced; the hedge rows being generally crooked and ſtunted in their growth, as not being ſo well protected when young.

QUESTION 12.

Whether there has been a greater quantity of woodland formerly producing oak converted to tillage within memory, than of land of a fit ſoil newly planted with oak?

ANSWERS.

Mr. Nichols.—I think much the ſame.

Mr. Harriſon.—More woodlands formerly producing oak converted to tillage, than land of a fit ſoil newly planted.

Mr. Evens.—From what obſervations I have made, it appears that there was formerly a greater quantity of woodlands producing oaks which is now converted to tillage, particularly in the corn counties. The new plantations that I know of are principally for hop poles, in the counties of Kent and Suſſex.

Mr. Croſs.—I believe there has been a greater quantity of woodlands, formerly producing oak, converted to tillage within memory, than of land of a fit ſoil newly planted with oaks.

Mr. Slade.—I have not a doubt but this country formerly was much more woody than at preſent, particularly near navigable rivers; which land has, many years ago, been converted to tillage; for as, on the one hand, the navy has greatly increaſed both in number and ſize, ſo has commerce likewiſe, which has occaſioned great conſumption of timber; ſo, on the other, population has alſo increaſed, which has required more land to be cultivated into arable and paſture for the ſupport of the inhabitants and cattle. The fitteſt ſoil for the growth of timber alſo produces the beſt corn; and as one more ſpeedily makes a profitable return than the other, I conceive it natural for any man to take that which is moſt to his advantage.

QUESTION 13.

Whether the plantations which have been made within memory have been chiefly of oak, or of the kinds of trees not fit for the navy?

ANSWERS.

Mr. Nichols.—The cultivation of oak ſeems to have been the principal object in making plantations, unleſs they have been for pleaſure grounds.

Mr. Harriſon.—Chiefly of oak and beech.

Mr. Evens.—Thoſe new plantations have but few oaks, and are chiefly of aſh, cheſnut, and willow.

Mr. Croſs.—The plantations which have been made within memory may be one third with oaks, and two thirds with trees not fit for the navy.

Mr. Slade.—In the courſe of my ſurvey of the counties of Bucks, Bedford, Huntingdon, Northampton, Hertford, and Berkſhire, I obſerved many plantations of young oaks from 5 feet to 25 feet in each (particularly in Berkſhire and Bedfordſhire); I ſaw alſo ſeveral plantations of beech and aſh (perhaps on a ſoil beſt adapted); they grew faſt and made quick returns, moſt to the advantage of the preſent owner, whilſt the oak, being of ſlow growth, was not quite ſo much coveted.

QUESTION 14.

Whether there are any commons or commonable woods of conſiderable extent in thoſe counties? and, Whether the quantity of timber growing in ſuch woods or commons is conſiderable?

ANSWERS.

Mr. Nichols. There are great quantities of oaks growing on commonable lands in many parts of the kingdom.

Mr. Harriſon.—In ſeveral of the above-mentioned counties, there are commons of conſiderable extent, and in ſome of them large commonable woodlands, producing underwood but very little timber.

Mr. Evens. I know of no commons with timber on them in Kent, Suſſex, Eſſex, Suffolk, and Norfolk, which are the counties I am moſt acquainted with; but there is a large extent of woodland in the neighbourhood of Geddington and Brigſtock, in Northamptonſhire, with large oak timber on it.

Mr. Croſs.—There are many commons; but do not recollect much commonable woods of conſiderable extent in theſe counties; the quantity of wood growing in ſuch woods or commons is inconſiderable, but in general headed and made pollards, ſuppoſe by the commoners in oppoſition to the lords, the planters.

Mr. Slade.—I am not acquainted with any (except the royal foreſts) of any extent; but I ſhould ſuppoſe many of the common lands might be converted to ſuch a purpoſe, where the ſoil is friendly for it.

QUESTION 15.

Whether the timber in ſuch commons or commonable woods is well preſerved, or ſuffers great depredation and waſte?

ANSWERS.

Mr. Nichols.—Generally well taken care of, being private property.

Mr. Harriſon.—In general not preſerved; but much injured by lopping, or cut down before it arrives at its full growth.

Mr. Evens.—The mode practiſed in falling the wood near Geddington is in ſeparate parcels, which, on their beginning to fall, is uſually incloſed with a high raddle fence ſo as to keep the deer out, and all kinds of ſtock; which part, I am informed, is laid open again after ſeven years; which I conceive to be too ſhort a period, and ought to be extended to fourteen years at leaſt.

Mr. Croſs.—The timber in ſuch commons or commonable woods is not well preſerved, but ſuffers great depredations, and others total waſte.

Mr. Slade.—In the counties where poor people abound, and woods are near, and fuel dear, great waſte is made by bowing and cutting off the branches and limbs, to the utter deſtruction of the timber, eſpecially when young.

QUESTION 16.

Whether on ſuch commons or commonable woodlands as have been divided and incloſed any conſiderable quantities of wood or timber have been raiſed?

ANSWERS.

Mr. Nichols.—Not much that I know of.

Mr. Harriſon.—Commons that have been incloſed are, I believe, in general cultivated for tillage or paſture; commonable woodlands incloſed, the greateſt part of them preſerved for underwood, and not ſo much for timber.

Mr. Evens.—I know of no new incloſures of woodlands in thoſe counties, but all incloſures are converted to arable lands.

Mr. Croſs.—On ſuch commons or commonable woodlands as have been divided and incloſed, conſiderable hedge-rows have been planted, but in general do not ſeem in a thriving ſtate.

Mr. Slade.—I know of none; and I am of opinion no incloſed land was ever intended to raiſe oak timber, except what may by chance be raiſed in the hedge-rows. Timber, inſtead of being the firſt conſideration, is generally the laſt, as the advantage ariſing from it being very remote.

QUESTION 17.

Whether a farther diviſion and incloſure of ſuch commons or commonable woodlands would, in your opinion, be the means of increaſing the quantity of wood and timber?

Any other obſervations or informations on the ſubject of the preceding Queſtions will be very acceptable.

ANSWERS.

Mr. Nichols.—I am inclinable to believe that it would be the means of increaſing the propagation of timber.

Redbridge, Thomas Nichols,
28th April 1791. Purveyor of Portſmouth dock yard.

Mr. Harriſon.—It certainly would, provided the incloſures were properly fenced and looked after.

Lidney, Thomas Harriſon,
28th April 1791. Purveyor of Plymouth dock yard.

Mr. Evens.—In my opinion the incloſing ſuch commonable woodland, as the ſoil is proper for the growth of oaks, would be a great means of increaſing the quantity of oak timber, provided the incloſures were attended to ſo as to prevent the bite of cattle, deer, or ſheep, and that none ſhould be ſuffered to be cut down improperly.

N. B.—I am farther of opinion, that another great cauſe of the decreaſe of oak timber, fit for the uſe of his majeſty's navy, is occaſioned by the building of ſhips for the Eaſt India Company of ſuch large dimenſions as they do at preſent.

Chatham Dock,
29th April 1791.

Mr. Croſs.—Commons or commonable woodlands of a fertile deſcription, if incloſed, may be the means of increaſing wood and timber for a certainty.

The ſetting acorns in woods, hedge-rows, &c. where timber is found to thrive, is the ſureſt mode to raiſe good ſound timber. Millions of pollards of ſorts now ſtanding in woods, fields, hedge-rows, &c. in ſaid counties, if a part, or one third, was taken down, and acorns ſet inſtead, would make room for young oaks, and do the farmer leſs harm for many years to come than ſaid pollards. There are many good nurſerymen in raiſing and preſerving oak trees, but there ſeems many to declare—Oaks, you are my enemies, I will neglect you, I will deſtroy you root and branch.

Navy Office, John Croſs.
4th May 1791.

Mr. Slade.—As per Anſwer to the 14th Queſtion, I am of opinion ſome lands now lying waſte and common, where the ſoil is friendly to the purpoſe of raiſing timber, might be incloſed for that purpoſe; the acorn to be taken from ſome of the royal foreſts, as from Dean Foreſt in Glouceſterſhire, which produces a faſt-growing timber and ſound; as alſo the New Foreſt, from whence very good timber is taken. A ſtiff clay or loam is the propereſt ſoil to produce timber of a cloſe connected ſtrong texture, but is of ſlow growth. A ſandy or gravel or ſwampy land will produce timber of a faſt growth, but it will prove porous and ſhakey, and not ſo ſerviceable.

Honourable Gentlemen,

I have endeavoured to anſwer your Queſtions in the beſt manner I am able, or time would admit. Oak timber is become a very ſerious inquiry to this country, whoſe preſervation greatly depends on a navy and opulence, and ſupport on commerce, both of which conſumes great quantities of the native wood of the country, more particularly of the large ſort. The ſhips of war not only increaſe in number but alſo in ſize; ſmall timber cannot do for conſtructions of that kind; Eaſt India ſhips alſo increaſe in magnitude from 750 tons to near 1,300 tons, the burthen of a 64 gun ſhip, and ſcantlings as large. Where then is large timber to come from to ſupply the conſumption? It is the opinion of many timber dealers there is not growth ſufficient to anſwer it now; and if a war was to happen, and continue a few years, the ſcarcity would become greater, and conſumption unanſwerable. The royal foreſts are yearly diminiſhing, on which muſt be great dependence. From experience the laſt war, the dock yards were very thin and ſupplies uncertain, becauſe the merchant builders gave ſuperior prices; and although they built ſhips of war, and the timber was expended for that purpoſe, they had a higher price per ton, which was unavoidable. As oak timber becomes more ſcarce, ſhould not a ſubſtitute be found to relieve the conſumption as much as poſſible? Cheſnut, when young, is free from ſhake, which it is too apt to be when old. Knees from that tree may be uſed inſtead of oak, which are become very ſcarce, more ſo ſince no contracts have been made from the county of Stafford, from whence much knee timber uſed to be had. I am humbly of opinion, very excellent live oak knees may be procured from ſome parts of America, which are almoſt everlaſting, and may be produced at as cheap a rate converted, as thoſe which are ſupplied by the converting contractors. I know they are more ponderous, but as they are ſtrong they may be of leſs ſcantling; and I ſuppoſe other particulars might be produced from thence fit for building ſhips of the navy: timber is brought from the Welch counties at a heavy expence. I know in Montgomery there is a large quantity of large maiden oak timber, which is the property of a gentleman who does not mean to fall it; it grows in woods, and the land carriage not very great. There is timber in other parts of Wales, but, having been inacceſſible, is become old and decaying; fuel being ſcarce in that country, it has been bowed. Moſt of the timber which grew on the eſtates of Guy's Hoſpital in the county of Hereford, has been cut down within 25 years, and great part ſent into his Majeſty's yards. The timber merchant at preſent having no other market for timber than Government, and the ſtores being well ſupplied, would it not be good policy to huſband the royal foreſts as much as poſſible againſt the time of neceſſity? Contractors for timber are now become very few in number, and from ſcarcity of timber they are obliged to go to diſtant parts of the kingdom, at a great expence, to procure it. There has not been any advance in the price of timber from Government ſince 1753, except a little in the articles of plank knees and tree nails, whilſt the contractor gives more than thirty per cent advance price. The beſt method to remedy this evil muſt be left to your Honours' conſideration, to which it is moſt humbly ſubmitted by,

Honourable Gentlemen,
Your moſt obedient humble ſervant,
Benjamin Slade.

Deptford,
23d April 1791.

No. 4.

QUESTIONS propoſed by THOMAS MITCHELL, *Eſq. late Firſt Aſſiſtant to the Surveyor of the Navy, at the Deſire of the Commiſſioners of the Land Revenue, to*

Mr. Wells,
Mr. Barnard,
Mr. Hilhouſe,
Mr. Nowlan,
} Merchant Ship Builders;
Mr. Binmer, late Second and now Firſt Aſſiſtant to the Surveyor of the Navy; and
Mr. Poore, Timber Merchant;

with their Anſwers.

QUESTION 1.

Has the price of great oak timber increaſed? and, if it has, How much ſince the year 1771?—The ſame Queſtion as to timber of middling ſize, and the ſame as to what is only fit for the uſe of the carpenter.

ANSWERS.

Mr. Wells.—The price of large oak timber in the year 1771 and 1772 was higher than ever was known, owing to a ſudden demand for timber. From 1772 to 1774 it fell in price from five to ten ſhillings per load; ſince that time it has not varied much, nor has the middling ſize timber.

Mr. Barnard.—Large timber has increaſed in price, from 1771 to 1785, ten ſhillings per load. Middling ſize timber within the ſame period, ſix ſhillings per load. That which is fit for carpenters uſe within the ſame period, one ſhilling and ſixpence per load.

Mr. Hilhouſe.—The price of large oak timber has increaſed to the conſumer at the rate of about five ſhillings per ton; middling ſize timber has increaſed in nearly the ſame proportion.

Mr. Binmer.—There is no doubt but the price of large oak timber has increaſed ſince 1771, not a great deal in his Majeſty's ſervice, but to the merchant builder it may, from five to ſeven ſhillings per load; but indeed they are beſt qualified to anſwer this Queſtion. A merchant contracting with Government for building a capital ſhip or ſhips is of courſe immediately to look out for timber to enable him to launch the ſhip in the time contracted for; if for a ſhort time the timber merchant takes an advantage by raiſing the price, knowing the merchant's neceſſity. It may again happen the timber merchant has a very handſome lot of compaſs or crooked timber; he here again takes another advantage, well knowing this timber muſt be had, and that it is always marketable; ſo that to a merchant builder it would be ſomewhat difficult to ſay the advance, without taking the whole of the timber uſed in the ſhip and ſtriking the average. This method of courſe would take in large, middling, and ſmall; and with reſpect to thick-ſtuff, from 8½ to five inches, together with knees, which they have purchaſed ſeparate from other timber, they have given great prices for. This and plank is the only article the Navy Board has advanced the price on ſince 1771.

Mr. Nowlan.—The price for large naval timber, as received in his Majeſty's dock-yards in the year 1771, remains unaltered; but contractors to build ſhips of war and ſhips for the Eaſt India ſervice, pay from five to ſeven ſhillings per load more than the price given to timber merchants to ſupply his Majeſty's dock yards. The reaſon, in my opinion, is, the timber merchant has a certainty both in payments and a continued demand for naval timber. But the merchant builder's demand is uncertain, after their preſent engagements, and a poſſibility of failure in payments, which too often is occaſioned from unforeſeen diſappointments, ſuch as defects, opening in the timber knees, &c. &c. After repeated anxious and expenſive journies, the individual who has not fortune ſufficient to ſupport ſuch repeated loſſes, muſt *fall* in a wide field of ſpeculation: for ſuch is ſhip-building on a large and extenſive ſcale. Every other buſineſs is almoſt reduced in their dealings to nearly a certainty in calculation. Timber of middling ſize for frigates and other ſmall ſcantling ſhips, is advanced on an average about five ſhillings per load; and the quality of ſuch timber much inferior, relative to its converſion, than what it was before, and ſome time ſince 1771. The reaſon I will give in anſwer to the 4th queſtion. The ſmall timber fit only for the carpenter is nearly the ſame price as in 1771; the reaſon, I ſuppoſe, from numbers ſtopping in their growth before they arrive to ſize ſufficient for the uſe of ſhip-building; and I fear too many thriving young oaks fall by an equally hurtful order, from motives of covetouſneſs or extravagant effects; which, if it was poſſible, ſhould be prevented, as the preſervation of ſuch oaks is of the greateſt importance to his Majeſty's dominions for future dependence.

Mr. Poore.—The price of large timber continues the ſame at the King's yards as in 1771; when King's ſhips were building in merchants yards, five ſhillings per load was in general given more than at the King's yards. Small timber has been fluctuating, ſometimes more and ſometimes leſs, is now nearly the ſame.

QUESTION 2.

Do you think the quantity of each of thoſe kinds, now growing in England, has decreaſed? and if ſo, In what proportion within the ſame time?

ANSWERS.

Mr. Wells.—The quantity of timber of all kinds has decreaſed ſince the year 1771, but the larger ſort in a greater proportion.

Mr. Barnard.—The large timber, from the great conſumption from 1774 to 1785, has decreaſed in the counties within my knowledge (viz. Kent, Suſſex, Surrey, Middleſex, Eſſex, Suffolk, Norfolk, Oxfordſhire, and Berkſhire), one tenth part; the middling ſize within the ſame one twentieth; the ſmall, as ſooner coming to growth fit for carpenters uſe, has been decreaſed only in proportion as woodlands have been ſtubbed up.

Mr. Hilhouſe.—I think the quantity of each has decreaſed very conſiderably, the proportion of ſuch decreaſe I am not competent to determine.

Mr. Binmer.—To judge the proportion of decreaſe would be ſomewhat difficult: that it has decreaſed there is not a doubt, as I apprehend an increaſe in price muſt ſhew a decreaſe of timber; the decreaſe I ſuppoſe to be in proportion as from the timber uſed in a firſt rate to that of a ſloop.

Mr. Nowlan.—Naval timber, growing ſince 1771, has decreaſed full half, from the great demand laſt war for ſhips of all claſſes built for his Majeſty's ſervice in the royal dock yards and by contract. The middling ſize, from the late demand, until the concluſion of the war, has decreaſed about one third; and ſince the concluſion of the war to this time, but little decreaſe has taken place. As ſtore-ſhips, tranſports, &c. have, ſince the war, returned from Government ſervice into trade; conſequently leſs occaſion for the conſumption of middling ſize oaks in the merchants ſervice. The dearth of merchant ſhip-building, at this time, is a ſufficient proof that the number of trading veſſels are equal to the commerce of the firſt commercial nation in the world. The decreaſe of ſmall growing oak timber ſince 1771, is about one fifth.

QUESTION 3.

Has the conſumption of timber for naval uſe increaſed in that time?

ANSWERS.

ANSWERS.

Mr. Wells.—The demand for timber for naval uſe has been greater in that time than ever I remember.

Mr. Barnard.—The conſumption of timber for naval uſes increaſed, from 1774 to 1785, beyond what this country ever experienced in three times the number of years.

Mr. Hilhouſe.—The conſumption of naval timber has very much increaſed during that time.

Mr. Binmer.—That the conſumption of timber has increaſed ſince that time there cannot be a doubt, as to my knowledge there has been not leſs than 40 ſhips of the line, and 130 from 50 guns to ſloops, built in the merchants yards for his Majeſty's ſervice; and that planting has not been equal to the conſumption, few will doubt. Indeed the building in the royal dock yards, particularly Portſmouth and Plymouth, has not been great, as the continual fitting of fleets to ſea has been at thoſe places the principal object; this muſt have occaſioned a great quantity of timber and plank, but moſtly the latter.

Mr. Nowlan.—The conſumption of naval timber, ſince the year 1771, is full half more.

QUESTION 4.

If you ſhould be of opinion that the quantity growing has decreaſed very much, that the conſumption for the navy and for trading ſhips is greater, and yet that the price is not much higher than it was in 1771, to what cauſe do you impute there not having been a greater riſe in the price?

ANSWERS.

Mr. Wells.—Timber, like every other article of trade, the greater the demand for it the more will be brought to market: add to this the great neceſſity many gentlemen of landed property were under to fall their timber; and alſo the very amazing and rapid improvements in roads and navigation within the time mentioned, which brought many thouſand loads of timber to market that before no one would have attempted to move, as the expence of carriage would have been too great.

Mr. Barnard.—The little fluctuation of price of oak timber has been principally owing to the ſteadineſs of Government's contract prices.

Mr. Hilhouſe.—I am opinion that the quantity growing has much decreaſed; that the conſumption for the navy and trading veſſels is greater; and that ſome of the cauſes why the riſe in the price has not been greater are, the great demand there was for money among the country gentlemen; the great increaſe of the value of land after it has been cleared, which in many places has been from ſeven ſhillings per acre to thirty-five ſhillings; the navigable cuts which have rendered the communication with the inland and interior parts of the kingdom ſo much eaſier than formerly for carriage, by which means capital timber, that otherwiſe never would or could have been brought to a naval market (owing to the great expence of land carriage attending it), has been rendered to the conſumer at a leſs price than the carriage alone would have coſt before thoſe cuts were made.

Mr. Binmer.—I am of opinion there has been a decreaſe, as by my Anſwer to the ſecond article; and that the conſumption for the navy has been very great, I have endeavoured to prove by the third article: and am further of opinion, that the conſumption for trading ſhips in the ſame time has been about half what has been uſed for ſhips of the navy built in merchants yards. One reaſon, I apprehend, that timber has not increaſed in price, as might have been expected, equal to the conſumption, is, that the commiſſioners of the navy have taken great pains to keep the price down, and have ſucceeded. I have heard the merchant builders frequently declare they were under great obligations to the commiſſioners of the navy in keeping the timber merchants to ſome degree of reaſonable terms. On the other hand, the timber merchants declare, were they to raiſe the price to the navy and merchants (to any great degree), the grower would immediately advance upon them, and of courſe their profits would not be increaſed.

Mr. Nowlan.—It is my opinion, though the decreaſe of naval and merchant timber has been conſiderable ſince 1771, yet many owners of woodlands continue to diſpoſe of their property, for various reaſons, to timber merchants, who ſometimes purchaſe of thoſe gentlemen nearly at the price they did in 1771, but often at a greater price, eſpecially for large timber fit for his Majeſty's ſervice; conſequently the contractor's profit muſt be leſs ſince 1771. And a reaſon, as I conceive, the timber merchant does not increaſe his price on middling ſize oak timber more than five ſhillings per load, is from the general practice uſed by them in the converſion of ſuch timber, by cutting off all knees from it that will anſwer their contract in his Majeſty's dock yards, or to diſpoſe of to the merchant builder, who (prior to this mode of converſion by the timber merchant) purchaſed ſuch timber of them, with the advantage of knee limbs on the timber, conſequently the timber merchant's profit is in proportion to the purchaſer's loſs. It is poſſible a line may be drawn for each to have a ſufficient profit; but the principle of *ſelf* muſt be firſt reduced into the practice of that excellent rule—To do to others as we wiſh to be done unto.

Mr. Poore's Anſwer to the 2d, 3d, and 4th Queſtions.

Large timber much decreaſed, nearly half, from the large quantities uſed in the King's and merchant's yards in the late war, but never greater care taken to encourage the growth of oak timber than at this time through almoſt every county in the kingdom; little timber now uſed in private yards, merchant ſhips being very plenty, owing to the great number now in trade that were employed as tranſports in the late war. The price given to gentlemen for timber of different ſizes is more than in 1771, by which means there is ſcarcely any profit to be obtained by the merchant, although greater care is taken in the converſion in ſelecting knee timber, which has been hurtful to the builder in private yards.

QUESTION 5.

Has the price of ſhips built in private dock yards, either for the navy or for the Eaſt India Company, riſen? and if ſo, How much ſince 1771?

ANSWERS.

Mr. Wells.—The price of ſhips built either for the navy or the Eaſt India Company has varied very little in the time mentioned, except in the time of the war, when the price of Eaſt India ſhips got up from 12l. per ton to 13l. 10s. and 14l. 14s. and are now 13l.

Mr. Barnard.—Line of battle ſhips have increaſed 12s. per ton: frigates 7s. 6d. per ton; ſhips of 800 tons for the Eaſt India Company's ſervice, 40s. per ton.

Mr. Hilhouſe.—The price of ſhips built in the private yards for the navy hath riſen ſince the year 1771 about 5s. per ton; the Eaſt India ſhips about 40s. per ton.

Mr. Binmer.—The price both of ſhips of war and India ſhips has increaſed ſince 1771. Government was under contract for building ſhips of 74 guns in private yards and frigates in 1771. The price per ton (at that time) for building ſhips of 74 guns in the Thames was 17l. 5s. It has ſince increaſed to 17l. 17s. 6d. Frigates were then built for 11l. 11s. It has ſince increaſed to 11l. 15s. I think Eaſt India ſhips about 1770 were built at 11l. 12s. per ton, has ſince increaſed to 14l. 10s. and what was termed the full contract was 15l. They are now come back to 13l. which was the laſt price given for a ſhip of 1170 tons built in Blackwall yard.

Mr. Nowlan.—The price of ſhips built by contract for his Majeſty's ſervice, and thoſe for the Eaſt India Company, ſince 1771, has increaſed. A reference to the Navy Office books for the former, and application to the Builders in the river Thames for the latter, will give better information than I can poſſibly give.

Mr. Poore.—Ship builders in the Thames are beſt judges.

QUESTION 6.

Is the expence to the public of building a ſhip in the royal dock yards greater or leſs than in purchaſing a ſhip of equal rate and tonnage built in private dock yards, reckoning the price per load of the timber uſed the ſame in both?

both ?—And if there be any material difference, be ſo good as to mention what, in your opinion, is the cauſe of it.

ANSWERS.

Mr. Wells.—The expence to the public in building ſhips in the royal dock yards, I ſhould ſuppoſe is very conſiderably higher than in private yards.

Mr. Barnard.—If into the calculation of the expence of building any ſhip in the royal dock yards is admitted *that* ſhip's proportion of all the yard rent and expences, as is the caſe in calculation in private yards, it will be found they will at leaſt double the expence of thoſe built in the latter. The cauſes are various: much larger meetings and more unprofitable timber are purchaſed; large quantities of that purchaſed, by an overſtock and long keeping, are rendered unfit for uſe; extraordinary mode of converſion; very great difference in expence of workmanſhip; extraordinary conſumption of various materials uſed in building (not a part of the ſhips) in royal yards &c. &c.

Mr. Hilhouſe.—It is a general opinion, that the expence of building a ſhip in the royal yards is greater than it is in the private yards; I think ſo too, admitting the price of the timber uſed the ſame in both; one reaſon is, that the waſte and offal in the former is not ſo œconomically diſpoſed of, nor do the workmen labour ſo hard, as in the latter (the late mode of taſk work excepted).

Mr. Binmer.—I am of opinion that the ſhips built in the royal dock yards generally turn out to a greater expence than thoſe built in private yards. Many reaſons may be aſſigned for this cauſe: we commonly convert our frames or timbers of the ſhip much ſquarer; not that I know it to be much better for the ſhip, for the timber that grows neareſt the mould will be the beſt; in general the officers, converters of timber, and workmen, are much more in the habits of niceneſs in all reſpects than they are in the merchants yards, particularly as work within a few years was always performed by the day, and in the private yards always by the great; beſides, a much greater number of officers in proportion to the workmen is employed in the royal yards, to what there is in merchants yards, in a proportion of at leaſt ſix to one; all which, of courſe, muſt enhance the price of building in the royal yards.

Mr. Nowlan.—The returns of progreſs from the proper officers of his Majeſty's yards to the Navy Board of the expence of building there, give a more accurate account than I poſſibly can; and the price given to contractors to build ſhips for his Majeſty's ſervice, the Navy Office books mention. The cauſe of difference (for ſome there is), I judge, proceeds from the greater conſumption of timber, though reckoning the price per load uſed in both the ſame. No doubt, the officers in whoſe department it is to order and ſee the converſion of his Majeſty's timber, &c. &c. are careful judges; but the timber in general ſerved into the royal dock yards from his majeſty's foreſts, and by contract, is larger in general than what an individual builder can buy, the price given him for building conſidered; conſequently it is the builder's intereſt to purchaſe timber as near the ſcantlings required as poſſible: and here the contract timber merchant charges the individual often a price equal to larger meetings; but though ſuch charges I have experienced, yet the general conſumption of timber in his Majeſty's yards muſt exceed that of private yards conſumption. Was encouragement given to his Majeſty's ſubjects in *peace* to build ſhips of war from 74 guns to frigates, or leſſer claſſes if required, in private yards, and proper length of time given to ſeaſon *under a roofing*, it would have a national good effect; while firſt and ſecond rates, and the repairs of the navy in rotation, would be ample employment for his Majeſty's dock yards. The utility of the above mode to keep the navy in an effective ſtate, and the ſubject uſeful in his native country, is too obvious to require any explanation.

Mr. Poore.—The Navy Board, from the returns made at the dock yards, and from the contracts made with private builders, muſt know beſt.

QUESTION 7.

Is there any difference, and, if any, what difference in the duration of ſhips of war built or purchaſed?

QUESTION 8.

What is the cauſe of ſuch difference, and what do you conſider to be the duration of each at a medium, according to the mode of building hitherto uſed?

ANSWERS.

Mr. Wells.—I am of opinion the ſhips built in private dock yards would laſt much longer than thoſe built in the public, provided they were the ſame time building; and for this reaſon the private builder is obliged to be much more œconomical in the converſion of his timber than can be expected in the public yards; the timber therefore is nearer to the ſize for the uſe intended, and of conſequence much younger.

Mr. Barnard.—Ships built in private yards that have had equal time for ſeaſoning and building, and have been impartially treated under ſurvey and repair, have been, under ſimilar circumſtances, equally durable with thoſe built in the royal dock yards.

The Anſwer to the Seventh Queſtion fully anſwers the former part of the Eighth. It is difficult to average the duration of ſhips of war; the only approach to truth herein muſt ariſe from examination of official naval documents.

Mr. Hilhouſe.—The difference of the duration of ſhips, built or purchaſed, may be as ſeven is to ſix in favour of the former.

The cauſe of ſuch difference, ſuppoſing the ſhip in the royal yard to be built by the day, and one in the private yard by the job, conſiſts in the ſuperior goodneſs of the work on the former; but, according to the preſent mode of taſk-work in the royal yards, I do not think there is any conſiderable difference. The principal cauſe, I think, muſt be the longer time the former is in building more than the latter; for, were they both to remain the ſame time on the ſtocks, and their reſpective works carried on at the ſame ſeaſon of the year, the latter, in my opinion, would then have the advantage, from her materials being conſtantly expoſed to the weather, and not houſed or put under ſheds (as is the cuſtom in the royal yards), by which expoſure the ſour juices of the oak are drawn out by the wet and froſt, and are not ſo liable to heat after it is confined in the ſhip. Another cauſe is, the deficiency in caulking the latter, which, on the upper works, are never ſo carefully performed as in the former; and it is well known that the preſervation and duration of a ſhip depends on keeping her tight the firſt two years after ſhe is launched. A well-built ſhip in the royal yards will laſt from twelve to ſixteen years; in a private yard, from nine to fourteen years.

Mr. Binmer.—I ſhould conceive no very material difference in the duration of thoſe built in the King's yards and thoſe of private yards. The materials uſed of all kinds, I am clear, from an experience of eighteen years (having inſpected the ſhips building in merchants yards that time, under the immediate orders of the commiſſioners of the navy), that they are no way inferior to thoſe uſed in the royal yards. If the duration be any longer, it muſt proceed from the reaſons given in the ſixth article. To a ſhip of the line building in a private yard, one officer only is appointed by Government to be immediately on the ſpot, with the viſits of an Aſſiſtant Surveyor of the Navy once a week in the river Thames. This was the practice during the laſt war. On a ſhip of the line in the royal dock yards, there will be ſeldom leſs than ſix officers, beſides the occaſional viſits every day of the Builder and his two Aſſiſtants.

As in my opinion there appears no great difference in the duration of ſhips built in the royal dock yards and thoſe of private, I mean if built in the courſe of a war, and in the ſame time, which I preſume is ſtating it fair, their duration (ſuppoſing ſhips of the line) without any material repair, may arrive to eight years. If after that time they were to be regularly ſurveyed, I am of opinion a great deal of the frame (or timbers) would require ſhifting, and in general to come under the term of a middling repair; and I think it would appear clear, were the records of office ſearched, that ſuch has been the caſe, both of ſhips built in royal and private dock yards, agreeable to the mode of building practiſed in the laſt war.

Mr. Nowlan.—Whatever difference is found in the duration of ſhips built in his Majeſty's yards, and thoſe purchaſed by contract, muſt be in proportion to the difference of quality in the timber, &c. uſed in each, and the difference of time, and mode in ſeaſoning, in the King's and merchants yards.

The cauſe of difference of ſhips built in his Majeſty's dock yards, and thoſe by contract, often proceed from the ſupply of oak timber in the Royal dock yards being of the largeſt claſs, which generally overſtand its due time, conſequently its natural juices dried, and its progreſs to decay rapid. The ſhips built by contract generally have younger timber, as it is the Builder's intereſt to purchaſe as near the proper ſize ſuitable for the claſs building as poſſible; and if time ſufficient is given to the Contract Builders to let the frame, beams, knees, thick-ſtuff, and plank (all being under cover) thoroughly ſeaſon, the growing timber thus hardened will laſt longer than timber that has overſtood its time, though an equal time of ſeaſoning is given to both. The medium duration of ſhips built in his Majeſty's dock yards, and thoſe in contract, from the mode hitherto uſed, I leave to the information the Navy-Office Books will give of each.

Mr. Poore.—Were the ſhips built (or repaired) either in the King's or private yards properly ſeaſoned in their frames, and the plank, thick-ſtuff, &c. before put on, the duration would be nearly the ſame.

The duration of ſhips muſt chiefly depend on the time given for ſeaſoning; and where proper means are uſed to admit a free circulation of air; which has been too often proved, and will again, while green timber and plank are uſed in building and repairing.

QUESTION 9.

Can you ſuggeſt any improvement by which the duration of ſhips would be increaſed, and in which the expence would not exceed the value of the timber ſaved?—If you can, be ſo good as to ſtate it.

ANSWERS.

Mr. Wells.—The only improvement I can recommend, is the method uſed in the private yards with the Eaſt India ſhips, which is, to let the outſide plank be faſtened with bolts, the plank to be properly bored off for treenails, and the holes left open for the air to paſs through the timbers. This is, in my opinion, the beſt method ever adopted for ſeaſoning of ſhips.

Mr. Barnard.—By contracting for ſhips of war in private yards in the River Thames, limiting the time for ſeaſoning in their various ſtages of building, and finiſhing them in ſuch a time of year as ſhall ſecure them from damps, would be the trueſt œconomy, and means of obtaining a ſucceſſion of well-ſeaſoned ſhips for the ſupport of the Navy at a much cheaper rate, and prevent diſappointment, and the neceſſity that ariſes in time of war of building in great haſte, and with unſeaſoned materials. Laying them up under cover, with every poſſible part opened for a free current of dry air, would be the beſt preſervative.

Mr. Hilhouſe.—I can ſuggeſt no greater improvement, by which the duration of ſhips would be prolonged, than falling the timber in winter inſtead of the ſummer.

Mr. Binmer.—It was ſuggeſted by a late Surveyor of the Navy, Sir J. Williams, in the year 1771, before a Committee of the Honourable Houſe of Commons; upon a queſtion of this kind being aſked, his anſwer, I think, was nearly this: That after a ſhip, principally ſpeaking of ſhips of the line, was complete in her frame, which is, that every timber which forms the conſtruction be in its place, to continue in this poſition for ſix or twelve months, the latter, if the exigence of the times did not prevent it, that the juices might exhale by ſtanding nearly in the poſition each tree grew, together with the beams to be placed perpendicularly round the ſhip, with the knees of the lower deck; the thick-ſtuff to be ſet edgeways, and to have the ſame ſeaſoning. This method was complied with in ſome ſhips in the Royal Dock Yards, and in a leſſer degree in ſome building in private yards. I believe the effects of this method have not been clearly aſcertained. The war coming on prevented in great meaſure this practice. Another method, which we have not at all adopted, or in a very ſmall degree, is, after a ſhip's frame is complete, to bring on her wales and plank by bolting them partially to the timbers, boring all the holes through timber and plank, but not driving the treenails, which has been the common method practiſed; by which means there will be a free paſſage of air, and both timber and plank will be better ſeaſoned by the juices exuding freer by the perforation being made in the timber and plank. What is uſed of iron or copper more than in the common method, will be ſaved in treenails, as it was uſual to drive out the treenails that faſtened the without-board plank, that when the inſide ſtuff was brought on, both might be faſtened together, and thoſe treenails ſo drove out were never of any further uſe. Now no treenails will be uſed till the whole is faſtened together, which muſt be a great ſaving in that article of near one half. In this ſtate a ſhip of the line would be well ſeaſoned in one year, and prove a more laſting ſhip. This method has been uſed on India ſhips, and ſuggeſted by the preſent India Surveyor. Much has been ſaid on winter-felled timber, though this, I believe, was never properly aſcertained. Winter-felled timber has been uſed partially, but never to complete the frame of a ſhip. It certainly would be proper to try the experiment upon a ſingle ſhip of the line, or more if thought proper. I think it would prove at leaſt as durable as ſummer-felled. I ſhould again apprehend, that after the ſhips were complete in their frames, were ſheds erected over them, ſo as to keep them as dry as poſſible, with a free circulation of air, and in this poſition to remain twelve months, it might be a means of their longer durability.

Mr. Nowlan.—The durability of the navy is an object of ſo great importance to his Majeſty's dominions, that to anſwer this queſtion fully and effectually requires judgment ſuperior to mine. But as it is my duty to attempt, agreeable to your requeſt, your candour I know will excuſe. I conſider it would be a great means of duration to ſhips of war, and large merchant ſhips, if all large timber that has overſtood its proper time was to be in future converted for the lower part of ſhips, ſuch as dead-wood floors, midſhip firſt futtocks, and other timbers that is under the line of the light draught of water, as it is well known that parts of ſhips that have been under repair have been found ſound, when other parts have been in a ſtate of decay. Growing ſound timber ſhould be appropriated, from light draft of water, up. Beam pieces and thick-ſtuff ſhould be converted out of timber of growing quality. Knees ſhould be regarded more for their ſtrength than largeneſs, for the growth of knees in general hold not in the arm a proportion with the body; and a ſtrong growing limb, if leſs one inch in the arm than its reſpective ſidings, is preferable in ſtrength to one more ſquare, if overſtood its time. The growth of all ſhips frames ſhould be regarded more for its ſtrength than ſquareneſs. An early proviſion of beam pieces, knees, thick ſtuff, and plank, ſhould be made and diſpoſed of under ſheds. That the butt end of the beams be bored, as ſoon as converted, from butt to ſcarph, with a proportioned ſize auger to their reſpective ſcantlings; and to be met there with an in-and-out hole, to give a free paſſage of air through the body of each piece, and then put away on ſkidds under ſheds. That a running groove be cut from hole to hole, when the ſcarphs are fayed, to give entire paſſage of air to the beam when together. Perforating the beams in the center of the body will have the deſired effect. After the frame has ſtood its time to ſeaſon, I am of opinion, that grooving up the backs of the timbers with one or two grooves in the middle, clear of the auger hole (which ſhould be bored one third from each edge), will admit air between the plank and timber. Tranſoms the ſame; and every other part of the ſhip where air is wanting. All knees grooved, and upper edge of clamps alſo. When the plank is bringing on the bottom and ſides, copper bolts drove where neceſſary, while the ſets are on, will have the deſired effect to keep the plank cloſe to the timbers; and as ſoon as the ſets are removed, to make it a general rule to bore off, that the *in*, or timber ſide of the plank may get air as ſoon as poſſible, and dry the dampneſs occaſioned from the kiln or ſteam: the interior part of the frame will effectually ſeaſon by this means alſo. The bad effects of driving treenails while the ſets are on the plank for a temporary purpoſe, is too often known; it not only prevents air where it ſhould have a free paſſage, but on driving out thoſe treenails when the inſide ſtuff is bringing on, frequently ſtarts off the plank; and I have known in his Majeſty's yards, and contractors, that the efforts to get it too, have proved ineffectual. The conſequence is then bad indeed; for that part neceſſarily muſt be *reduced* to the other part of the bottom, which ſhould, in my opinion, have half an inch added to the thickneſs of all bottoms. The dependence of men's lives is in the ſecurity of the outſide plank. It would add much to the duration of ſhips if their bottoms and ſides were to be completely bored off as the planks are brought in, with an augur one quarter of an inch leſs than the finiſhing ſize, for a general and free circulation of air. That the foot-waleing as brought on to be run through with the ſame ſize auger, and then to bolt or nail, as the thickneſs of the inſide ſtuff requires, before the ſets are removed. This method will not only keep the inſide ſtuff to the timbers, but by boring off before the faſtenings are drove inſide, the ſhipwright has an opportunity of dividing his faſtenings between the auger holes, which, though regularly diſpoſed of on the outſide, from the croſſing of the edges of plank, of courſe make irregular diſtances inſide, which method, if uſed, will make the faſtenings regular; and in this ſtate the outſide and inſide plank, independent of a ſingle treenail, remains ſecurely faſt; the ſhip receiving, in the moſt interior parts of her ſcantling, a thorough ſeaſoning, as kneeing the beams, faying the deck hooks, &c. is ſo connected with other depending works on them, that they ſhould be early ſaved and bored off, and left unbolted as long as poſſible to give air to the interior part of the knees and hooks. When it is neceſſary to drive off the treenails, which ſhould be all mooted, and in a perfect ſeaſoned ſtate, a dry ſeaſon ſhould be taken to bore all the holes with the proper ſized augers, which will cut all the ſhagged wood and dirt that may have collected, and will prepare the hole for the treenail in a horny ſeaſoned ſtate. Were ſhips to be houſed over, wet weather would not retard the buſineſs, nor injure the ſhip in ſuch a ſtage of the buſineſs. As ſoon as the inſide ſtuff will admit, the riders, hooks, ſteps, crutches, ſleepers, &c. to be fayed. They ſhould be done, and bored off, with an auger one eighth inch leſs than the proper ſize, then cleared off from their reſpective ſtations, and remain ſo as long as the works depending on them will admit; and, when neceſſary to bolt them, they will be in a more ſeaſoned ſtate than if fayed (often not ſufficiently ſeaſoned), bored off, and bolted without the advantage of ſo much time given them as the method I propoſe. Tar and hair, where grooving cannot with propriety be done, is a good ſubſtitute, provided the part it is applied to is ſeaſoned. The houſing over ſhips may be quarter inch deals, and remove them with ſucceſſion of new ones. The ſeaſoned ones fit for bulkheads, ſtore-rooms, &c. &c.

Mr. Poore.—The reaſon given in the Seventh Anſwer, by being well ſeaſoned. An allowance made to a contractor for the time will be amply paid by the duration.

QUESTION 10.

Has Government any competitor beſides the Eaſt India Company in the purchaſe of great oak timber?

ANSWERS.

Mr. Wells.—None that I know of.

Mr. Barnard.—Great quantities of oak ſtaves for the brewery have been, in the laſt twelve years, cut from the clean part of the bodies of large oak trees; and ſeveral, very extenſively in that trade, are wholly ſupplied therewith from the county of Suſſex?

Mr. Hilhouſe.—Government has no competitor of conſequence, in the purchaſe of large oak timber, except the Eaſt India Company.

Mr. Binmer.—Not any, to my knowledge.

Mr. Nowlan.—Government has no competitors beſides the Eaſt India Company in the purchaſe of large oak timber.—There is a trivial exception; for in ſome interior parts I have ſeen ſome large ſtraight oak converted for the coopers and carpenters uſe; but, in general, it is timber that through age has loſt its ſtrength that coopers prefer, and of courſe what ſhipbuilders ſhould reject, being unfit for ſo great a purpoſe. No doubt ſome of the large timber would be worth the extra land carriage expence, was it allowed from Government to the timber merchant, to encourage him to purchaſe what is fit for naval uſe. There is no great danger to apprehend from the miſapplication of valuable oak, as all owners of timber in England, at this day, have ſufficient knowledge of the uſe of ſhip timber, and the greater advantage it is to them to ſell a quantity to a timber merchant, in preference to coopers, carpenters, &c. &c.

Mr. Poore.—Beſides the Eaſt India Company, great quantities of large ſtraight timber is cut up for coopers, and other uſes, that would be uſeful and ſerviceable to the Navy. Was a greater price given to the timber merchant, to enable and encourage him to pay a longer carriage, the evil would, in a great meaſure, be prevented.

QUESTION 11.

What do you underſtand to be the medium duration of Eaſt India ſhips?

ANSWERS.

Mr. Wells.—Eaſt India ſhips have, for many years, been confined to go only four voyages, which were of late performed in about twelve years. They have now leave to go five voyages, which may prolong the time eighteen or twenty months.

Mr. Barnard.—Fifteen years.

Mr. Hilhouſe.—I underſtand the medium duration of Eaſt India ſhips to be ſix years (or rather ſix voyages), which formerly was but for four voyages.

Mr. Binmer.—By every thing I have heard, and every inquiry made, the medium of their time in the Eaſt India Company's ſervice is from twelve to fourteen years.

Mr. Nowlan.—The medium duration of ſhips built for the Eaſt India Company's ſervice, from the ſalutary mode now practiſed, by leaving open all treenail holes, &c. as long as poſſible (which certainly ſeaſons the frame in one tenth of the time that was formerly practiſed, while the plank benefits alſo), and the great advantage of copper faſtenings, and copper ſheathing, is alſo an addition to the durability of thoſe ſhips, as it effectually prevents the worm, ſo deſtructive to ſhips in that climate without copper bottoms. The medium duration from the preſent mode of building is about eighteen years.

Mr. Poore.—The duration depends chiefly on the degree of ſeaſoning.

QUESTION 12.

Are the Eaſt India ſhips broken up after four voyages, or after what number? And is the timber taken out of ſuch ſhips of much or of any uſe in building other ſhips, for the Navy or Eaſt India ſervice?

ANSWERS.

Mr. Wells.—I have never known the timber taken out of the Eaſt India ſhips, when broken up, made uſe of in building ſhips for the Navy or Eaſt India ſervice. The old timber is ſometimes uſed in repairs of ſmaller ſhips.

Mr. Barnard.—Eaſt India ſhips have generally been broke up after four voyages, and have been found too unſound to apply any part of them to building ſhips of war, or for the ſame ſervice. The Eaſt India Company have thought proper, in 1788, to permit ſhips to go five or ſix voyages.

Mr. Hilhouſe.—The Eaſt India ſhips are now, in general, after ſix voyages, ſold into other ſervices; but when broken up, their timber is neither fit for the Navy, Eaſt India ſervice, or ſmaller merchant ſhips.

Mr. Binmer.—The Eaſt India ſhips are either broke up or ſold commonly after four voyages; few exceptions, I believe, to that time. Government has purchaſed ſeveral for ſtoreſhips, after their fourth voyage, during the laſt war; and, with a ſmall repair they have run four or five years. Some have been purchaſed for the bringing maſts from America, but the greateſt number are broke up. They are of no ſort of uſe in building other ſhips; if any part, the knees might be uſed, but this is ſeldom practiſed, as the bolt holes muſt be freſh bored, which muſt increaſe the ſize of the bolts, and render the knees much weaker.

Mr. Nowlan.—The Eaſt India ſhips, prior to the preſent mode of building them, have been broke up, ſome after four, ſome five voyages. Others have been purchaſed for maſt ſhips, &c. The timber of broken-up Eaſt India ſhips, or any other, is not fit to be put into a new ſhip, as the treenail holes, bolt holes, &c. in its firſt ſtate will claſh with thoſe bored in its ſecond, and of courſe render the ſtrength inſufficient. Knees of broken-up ſhips (if ſound) will anſwer repairs, which will be more reaſonable than new ones, and ſave the conſumption of ſuch, which ſhould be conſidered at all times.

Mr. Poore.—The breaking up, I ſhould ſuppoſe, would depend wholly on the ſtate the ſhips were found to be in. Whether after four or five voyages, when broken up, I ſhould conſider the timber unfit for uſes in either the Navy or the Company's ſhips.

QUESTION 13.

Has any ſubſtitute been found for Britiſh oak in ſhip-building that was not uſed before 1771? Is aſh timber, or the Spaniſh cheſnut, uſed for knees; and if ſo, in what quantity do you ſuppoſe them to be uſed? Are they found to anſwer the purpoſe, and to be nearly as durable as oak?

ANSWERS.

Mr. Wells.—I do not know of any ſubſtitute for Britiſh oak for ſhip-building, that was not uſed before 1771.

Mr. Barnard.—None that I know of. I have never ſeen either uſed in ſhip-building.

Mr. Hilhouſe.—There has been no ſubſtitute found for Britiſh oak in ſhip building ſince the year 1771, that I know of; aſh timber and cheſnut have been uſed for knees; the proportionable quantities I cannot determine; but I have ſeen inſtances wherein they have been uſed, but neither of them is as durable as oak. The cheſnut particularly is ſcarce worth the labour of faying and bolting.

Mr. Binmer.—I know of no ſubſtitute that has not been uſed ſince 1771 for Britiſh oak. I never ſaw any knees of aſh uſed, neither of cheſnut, but know of no reaſon why they ſhould not anſwer the purpoſe, their grain being much like that of oak. The Navy Board, in order to ſave the conſumption of oak, have ordered in the different King's Yards, beech, elm timber, and plank, to be made uſe of in ſundry parts of ſhips expreſſed to them; alſo aſh and cheſnut knees; and from the information the Board have had from ſeveral of the timber merchants, there is almoſt a certainty of getting ſuch a number of aſh and cheſnut knees as will occaſion a material ſaving of oak. As elm trees are not mentioned, I cannot help thinking they would anſwer the purpoſe in dry parts of the ſhip expoſed to air, near as well as aſh and cheſnut, and bear bolting much better.

Mr. Nowlan.—No ſubſtitute experimentally has been found for Britiſh oak in ſhip-building, that was not before 1771; but aſh knees are now admitted by the Commiſſioners of the Navy in the timber merchants contract. I am of opinion, that aſh and Spaniſh cheſnut, if uſed for knees, where they will remain dry, will anſwer both in ſtrength and duration, nearly as long as oak; and as aſh in general ſtops in growth before it gets to the ſize of oak, it would favour the conſumption of Engliſh oak by uſing it for top timbers, quarter deck and forecaſtle beams, pillars, wing ſtantions, bulkhead ſtantions, &c. and wherever dry ſcantlings are required, provided it is a dry ſituation in the ſhip.

Mr. Poore.—No ſubſtitute has been found. Cheſnut and aſh knees would, if kept dry, laſt many years.

QUESTION 14.

Do aſh, Spaniſh cheſnut, and oak require different kinds of ſoil, or would the ſoil on which either of the two firſt grow produce oak of equal ſize?

ANSWERS.

Mr. Wells.—Aſh grows beſt in chalky ſoil, cheſnut in ſandy or light ſoil, oak in a ſtiff or dry ſoil; the oak will therefore not grow where the other two will.

Mr. Barnard.—So far as I have obſerved, the ſoil favourable to the growth of oak is equally ſo to the other two.

Mr. Hilhouſe.—I believe aſh requires a moiſter ſoil than the oak, but cheſnut and oak will thrive equally in the ſame.

Mr. Binmer.—It was never the practice to uſe aſh any where in a ſhip, except for capſtand bars. I apprehend it will grow in any ſoil it not too wet. With reſpect to Spaniſh cheſnut, for plantations of timber trees, you can hardly go miſs, ſo there be a depth of ſoil, and no ſtanding water. They will grow on obſtinate clay, and the bleakeſt declivity of hills. This tree, where fruit is not the object, being more patient of cold than heat, it may anſwer moſt of the purpoſes of oak. In Italy, the beſt caſks for wine and other liquors are made of this wood, which, it is ſaid, has the property, when thoroughly ſeaſoned, of maintaining its bulk without ſhrinking or ſwelling, which moſt other timber does; and formerly was built of it great part of the ancient city of London (and other ancient cities of the kingdom) near which were large foreſts of cheſnut trees, which whether or not a native of this iſland, is not well determined. If they grow on an obſtinate clay, no doubt it will produce oak of equal ſize.

Mr. Nowlan.—From my obſervation of the growth of aſh and cheſnut, with the oak in the New Foreſt, and the Foreſt of Bere, and many coppices, I find the aſh will grow to its uſual extent near to the oak, and of the ſame ſoil; cheſnut will the ſame. The ſoil I have remarked, where aſh, cheſnut, and oak, thrive alike in proportion to their different qualities, is in dark-brown loom ſoil. In Suſſex the quality of oak is excellent, but the growth tedious; and the ſoil, which is clay, too ſtrong for the growth of aſh or cheſnut.

Mr. Poore.—Aſh and cheſnut require a drier ſoil than oak; but oak will grow to great ſize on a dry, if a deep ſoil.

QUESTION 15.

Do you know what is the common duration of the Ruſſian ſhips built of larch or larix timber?

ANSWERS.

Mr. Wells.—As to this Queſtion I can ſay but little, as foreigners make their ſhips, what they call, laſt much longer than we do. In ſome countries they double and treble their ſhips bottoms, and never conſider about the timbers, if rotten or ſound. They bolt the outſide plank through and through; clench the bolts inſide, and wholly depend upon the outſide plank, a method I ſhould by no means recommend.

Mr. Barnard.—I do not.

Mr. Hilhouſe.—See his Anſwer to the Sixteenth Queſtion.

Mr. Binmer.—I know but little of Ruſſian ſhips; but cannot ſuppoſe thoſe ſhips built of the larch or larix timber to be very durable, when compared to ſhips built of Britiſh oak, provided they were as much at ſea as a Britiſh ſhip generally is in time of war. I can hardly ſuppoſe thoſe ſhips to be wholly built of that timber, as in general it is perfectly ſtraight; and as the fore and aft part of ſhips, by their conſtruction, require crooked timber, I ſhould ſuppoſe had they compaſs oak, it would be uſed in thoſe parts, otherwiſe to mould a ſtraight piece to form a curve, it muſt of courſe be greatly grain-cut, and exceeding weak; particularly when the plank comes to be faſtened, by boring through thoſe timbers, I ſhould imagine would cauſe a ſeparation of the timber. If the knees are produced from the ſame timber, it can be only the roots, with part of the body, for the knee; and if the timbers, knees, and plank are all of this ſpecies of fir, they ſhould have a peculiar manner of bolting and clenching thoſe bolts, that when the ſhip works much at ſea, unleſs they have large ſaucer-headed bolts without, and clenched on plates within, the bolts by time would draw through thoſe ſoft materials, and render the ſhip very crazy, though the wood at the ſame time may be durable.

Mr. Nowlan.—I have known Archangel ſhips that have been from ten to ſixteen years built, and in a ſound ſtate, of the growth of that country, which is named larch or larix timber.

Mr. Poore.—Not acquainted.

QUESTION 16.

As the larch will grow on ſoil unfit for the oak, do you not think that the planting of that tree ſhould be encouraged, with a view to the future ſupply of the Navy?

ANSWERS.

Mr. Wells.—I cannot conceive the larch will ever be found uſeful or fit timber for the Navy.

Mr. Barnard.—As the larch will grow on ſoil unfit for oak, it is to me the ſtrongeſt proof that the cultivation of it would be uſeful, with a view to a future ſupply for the Navy.

Mr. Hilhouſe.—I can ſay nothing to theſe two Articles (15. 16).

Mr. Binmer.—As it will grow on ſoil and ſituations where oak will not grow, it certainly might with propriety be encouraged, particularly in the northern parts of this kingdom. It is a native of the Alpine and Pyrenean Mountains, is fond of an elevated ſituation, it will become a ſtately tree in the pooreſt hungry ſand and gravel, and on the higheſt and bleakeſt hills, where there is but few inches of ſoil; it rejects no quality of earth, but in wet lands it will not ſucceed.

An Author I have read on Foreſt Trees ſpeaks thus of the larch; and after ſpeaking of the many purpoſes it is fit for, concludes thus: "Nor was it uſed for theſe "purpoſes only, but for building of ſhips alſo." And Witſen, a Dutch Writer on Naval Architecture, mentions a ſhip to have been found, not long ſince, in the Numidian Seas, twelve fathoms under water, chiefly built of this timber and cypreſs, both reduced to that hardneſs as to reſiſt the ſharpeſt tools; nor was any part periſhed, though it had lain fourteen hundred years ſubmerged.

Mr. Nowlan.—From the duration of ſhips built of larch timber, and which will grow on poorer ſoil than oak requires, the planting of that tree ſhould be encouraged, to aſſiſt, in a future demand, the oak that will require longer time to grow to a valuable ſize; and as the larch is lighter in quality than the oak, it ſhould be appropriated in ſhip-building from the load ſeat of water up.

Mr. Poore.—The larch ſhould be encouraged, as it will flouriſh on a poorer ſoil than oak.

QUESTION 17.

Do you ſuppoſe that more ground has ſince been new planted within your recollection, than there has been of woodland turned into tillage, or the reverſe?

ANSWERS.

Mr. Wells.—I believe there are many thouſand acres of woodland grubbed more than has been new planted.

Greenland Dock, W. Wells.
April 10th, 1789.

Mr. Barnard.—I am certain not within the counties of Middleſex, Eſſex, Suffolk, Cambridgeſhire, Norfolk, Berkſhire, Oxfordſhire, Kent, Surrey, and Suſſex.

Deptford Green, W. Barnard.
March 19th, 1789.

Mr. Hilhouſe.—I do not ſuppoſe there has been one hundredth part of the land newly planted that has been turned into tillage.

Mr. Binmer.—By every information I can gather, it has been too much the faſhion to turn woodland into tillage in much greater proportion than the reverſe, as tillage in general brings its value each year when not fallow, while that of woodland muſt be a ſeries of years before any benefit can be reaped from the produce.

It may not be foreign from the ſubject to remark, that if timber on church lands were ſuffered to grow, and not taken down when not fit, by every new incumbent, together with proper attention to hedge rows, which will always produce the fineſt compaſs timber and knees, this alone would be quite ſufficient for building ſhips for the trading part of the nation; while the royal foreſts, if properly planted and well attended after planting, would, I believe, be quite ſufficient for the purpoſes of the Royal Navy. I beg leave to make a remark from one of the moſt eminent timber merchants of his time in this kingdom reſpecting hedge-rows. "In former leaſes "it was a condition not to plough within a rod of the hedges, within which places "has been produced many thouſand loads of fine timber; but ſo far from being ſo "now, the plough goes ſo near the hedge that you cannot walk round a field without "tearing your coat."

N. B. Mr. Mitchell has requeſted me to ſay he has peruſed thoſe Anſwers, and is entirely of my opinion.

J. Binmer.

Mr. Nowlan.—In Anſwer to the Seventeenth Queſtion relative to the proportion of woodlands, and that turned into tillage, I have made inquiry, and am informed from good authority, that the woodlands hold an equal proportion to that of tillage throughout the kingdom at this time. I will not differ from thoſe gentlemen who have been through more counties of England than I have, and doubt not ſome of them are as deſcribed by thoſe gentlemen; but from my knowledge of the counties of Hants, Wiltſhire, Suſſex, and Dorſetſhire, where I have bought timber, the woodlands hold not a proportion with the lands turned into tillage. But were gentlemen to make a true calculation of the advantage of planting oaks on land it is too expenſive to cultivate, they would be induced to attend to it even from motives of private intereſt, at leaſt to appropriate one third of their eſtates to the plantation of oaks, elms, beech, aſh, cheſnut, and larch. Firs are an unprofitable plant, that ſhould not take up the room of more uſeful trees, unleſs it was poſſible to grow firs for maſts, yards, &c. which I fear the climate will not anſwer for. An effort uſed would be a proof.

Mr. Poore.—As great a proportion of land is appropriated to the growth of timber now as has been for many years paſt: the method uſed in thinning properly the young trees is better known and more attended to than heretofore.

No. 5.

Gentlemen, Eaſt India Houſe, May 12, 1791.

IN conſequence of your application to the Court of Directors of the Eaſt India Company to permit me, as their Surveyor of Shipping, to anſwer ſuch Queſtions as you might think proper to put to me, I received their commands to communicate to you every information that you might deſire. I have accordingly conſidered the Queſtions ſent to me from your Board with the utmoſt attention I am capable of, and have given the fulleſt Anſwers thereto in my power, which are incloſed herewith.

If any thing that I have ſuggeſted may be of the leaſt ſervice to the public, it will give me the higheſt ſatisfaction; and I ſhall at all times be happy to communicate any further information in my power.

I am,
Gentlemen,
Your moſt obedient
Humble ſervant,
GAB. SNODGRASS.

The Commiſſioners of the
Land Revenue.

QUESTIONS propoſed by the Commiſſioners of the Land Revenue to Mr. GABRIEL SNODGRASS; *with his Anſwers thereto.*

QUESTION 1.

Does your opinion continue the ſame that you gave before the Committee of the Houſe of Commons in 1771 on all the points on which you were then examined *?—If not, be ſo good as to mention in what particular points it is altered.

ANSWER.

My opinion continues the ſame in all reſpects as at that time, except on the following points, viz.

Reſpecting the building of ſhips in docks my opinion is altered: I now think the building them on ſlips to be preferable; and if they are to ſtand any time to ſeaſon before they are launched, a ſhed or roof ſhould be built over them. But I ſtill continue of the ſame opinion, that the laying up old ſhips in docks, under cover, would be very proper; and that a few experiments of this kind ought to be made in ſome of his Majeſty's yards before it is generally adopted.

In the copy of my letter to John Purling, Eſq. printed with the Report of the Committee in 1771, (page 35) it is ſaid, that ſhips may go *eight* voyages to India in twelve or fourteen years: this muſt be a miſtake, as I never thought of ſhips going more than *ſix* voyages in that number of years.

In what is ſaid page 36 of that Report, reſpecting the not building ſhips for the navy in the merchants yards, my opinion is alſo altered: I am now certain that it would be much for the intereſt of the nation, and for the future good of the Navy, if Government were to contract for ſhips of war to be built in private yards in times of *peace*, or whenever there is but little work in thoſe yards; as proper time may then be allowed for the building and ſeaſoning of them, and proper attention paid to the materials, workmanſhip, &c. And this meaſure, for two good reaſons, *ought* to be adopted: Firſt, that Government may always have a ſucceſſion of ſeaſoned and durable ſhips at a moderate price, which would prevent the neceſſity that ariſes, in time of war, of building ſhips in great *haſte*, and with *green* materials, which certainly is the principal cauſe of the rapid decay of ſhips that are built in this manner, and of the *bad* ſtate of many of the ſhips of the preſent navy, and alſo of the extraordinary expence and conſumption of timber in building and repairing of them; and, ſecondly, that the ſhipwrights in the private yards may find conſtant employment, which would increaſe their numbers and continue them in this country, and be highly advantageous to the nation in time of war. The contractors may alſo undertake building ſhips in the King's yards by the ſhipwrights employed in thoſe yards, and ſlips may be ſeparated from the reſt of the yard by a fence put up for that purpoſe.

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* As ſome of our Readers may perhaps be deſirous of comparing the evidence given by Mr. Snodgraſs before this Committe with his preſent ſentiments on the ſame intereſting ſubject, the EDITOR of this Collection is luckily enabled to gratify their curioſity by having a copy of the Committee's Report in his poſſeſſion, and from which the Reader will find the Evidence given by Mr. Snodgraſs in 1771 annexed to this Paper in page 76, & Seqq.

It has been ſuggeſted by ſome gentlemen, that ſhips of war built in the merchants yards are not ſo durable as thoſe built in the king's yards. This certainly is a great miſtake, if the ſame time is allowed for the building and ſeaſoning, as in the King's yards, or the *fault* muſt be with thoſe who form the contracts, and ſhould ſee they are complied with; as it is well known and allowed, that the merchant builders buy ſounder and better timber in general than what is received into his Majeſty's yards for the uſe of the navy; conſequently, if ſhips built in the merchants yards were allowed a ſufficient time for ſeaſoning, &c. and properly attended to while building, there is no doubt but they would be equal, if not ſuperior, to ſhips built in any of his Majeſty's yards, and at a much cheaper rate. For if the prime coſt of a ſhip of war built in the merchants yards, was compared to the real expence of building one of the ſame dimenſions and ſcantlings in the King's yards, I much doubt whether the difference of the ſums would not be found nearly as *two* to *one*.

QUESTION 2.

What is the number of Britiſh built ſhips at this time in the ſervice of the Eaſt India Company on the eſtabliſhment? and, What is their tonnage?

ANSWER.

There are now 91 Britiſh ſhips built and building on the Company's eſtabliſhment, and the amount of their tonnage is about 79,913 tons.

QUESTION 3.

What other ſhips are conſtantly or occaſionally employed in the Company's ſervice? And to what amount of tonnage?

ANSWER.

Two ſhips, built at Bombay, are conſtantly employed in the Company's ſervice to and from India. The amount of their tonnage is 1,727 tons. Very few ſhips have been *occaſionally* employed, except lately, ſome few ſmall ſhips from Botany Bay have brought home teas from China.

QUESTION 4.

Are there any ſhips now building for the ſame ſervice, and of what tonnage? And are ſuch ſhips intended to be employed in the room of ſhips of equal tonnage, to be forthwith broken up or ſold, or in addition to the preſent ſhipping?

ANSWER.

Four ſhips are now building, of ſomething more than 1,200 tons each, in the room of four other ſhips of about 800 tons each, which are worn out and diſpoſed of by their owners.

QUESTION 5.

At what time did the reſtriction impoſed by the act of 12 Geo. III. againſt building more ſhips for the Eaſt India Company, until their whole tonnage ſhould be reduced to 45,000 tons, expire? And how ſoon after that reſtriction ceaſed did the Company begin to build and increaſe their ſhipping?

ANSWER.

I cannot tell the preciſe time the reſtriction expired, but ſuppoſe it was ſome time in 1776, as in that year the Company began to build and increaſe their ſhipping.

QUESTION 6.

Has the general conſumption of timber for the building and repairing of ſhips increaſed ſince the year 1771?

ANSWER.

The conſumption of timber, for the navy only, I ſuppoſe, has been more than double from 1771 to 1791, to what it was from 1751 to 1771, and the general tonnage of Eaſt India ſhipping (Britiſh built) has increaſed, ſince the year 1776, from about 45,000 tons to 79,913 tons, including the tonnage of the four ſhips now building.

QUESTION 7.

Is oak of any other country than Britain uſed in the conſtruction of Eaſt India ſhips? and if ſo, In what *proportion?*

ANSWER.

About one half of the plank of the bottoms of Eaſt India ſhips is Dantzick oak plank. No large foreign oak is uſed in any part of thoſe ſhips.

QUESTION 8.

From what part of Britain is the oak generally brought that is uſed for the conſtruction of Eaſt India ſhips?

ANSWER.

The merchant builders are not confined by their contracts to buy timber from any particular part of Britain, provided it is equal in goodneſs to that of the growth of Suſſex.

QUESTION 9.

What do you ſuppoſe to be the difference between foreign oak timber imported into this country, and that of Britiſh growth, in point of duration?

ANSWER.

All foreign oak imported into this country is very inferior to Engliſh oak, but I cannot aſcertain the exact difference in point of duration.

QUESTION 10.

Has the price of ſhips built for the Eaſt India Company riſen? and if ſo, How much ſince 1771?

ANSWER.

The price of ſhips built for the Eaſt India Company's ſervice has riſen ſince the year 1771, from twenty to forty ſhillings per ton, which has been occaſioned partly from their increaſed tonnage, partly from their being more ſubſtantially built, from the contracts being made fuller, and by not admitting ſo large extra bills as formerly.

QUESTION 11.

Has Government any competitor beſides the Eaſt India Company in the purchaſe of *large* oak timber fit for the uſe of the navy?

ANSWER.

There are certainly many more competitors in the purchaſe of large oak timber fit for the uſe of the navy than the Eaſt India Company; ſuch as the office of ordnance, brewers, millwrights, &c. &c. and no Britiſh ſhips of 300 tons, and upwards, are built without having ſome timber and plank uſed in them fit for the uſe of the Navy. But as the whole quantity of large oak timber uſed in the Eaſt India Company's ſervice, and for all other marine purpoſes, is ſo ſmall compared to that uſed for the Royal Navy, the Navy Board have it much in their power, at all times, to regulate the price. I am of opinion, that Eaſt India ſhips of 1,200 tons are built with timber of no larger meetings than is uſed for building and repairing the largeſt frigates in his Majeſty's yards.

QUESTION 12.

How long may it take to build an Eaſt India ſhip under the preſent regulations?

ANSWER.

Eighteen months is the ſhorteſt time allowed at preſent.

QUESTION 13.

How long under former regulations?

ANSWER.

I do not recollect any regulation for the time ſhips ſhould be in building formerly; ſome have been built in ſix months.

QUESTION 14.

How many voyages might a ſhip be able to perform under each circumſtance?

ANSWER.

The ſhips now in the Company's ſervice may go ſix voyages, if they can be performed in twelve years, with as much propriety as the former ſhips went four voyages.

QUESTION 15.

What is the length of time of a voyage in the Eaſt India Company's ſervice at preſent, and what was it uſually before the year 1771?

ANSWER.

The preſent ſhips, being coppered, make their paſſages out and home in about two months leſs time than the ſhips that were not coppered; but formerly, when the ſhips had *filled* bottoms (that is, filled with nails), and were kept going regularly, *they* made four voyages in eight years. The preſent ſhips do no more, as they do not go out until the ſeaſon after their arrival.

QUESTION 16.

After what number of voyages are Eaſt India ſhips uſually broken up or diſpoſed of?

ANSWER.

Uſually after having made four voyages: but lately the Company have given leave that all ſhips in their ſervice may go ſix voyages, if on examination the owners ſhould think them worth repairing. But it is very improbable that any of them will go more than ſix voyages in the Company's ſervice. When they have gone the number of voyages they are ſuppoſed to be fit for, they are either broken up or ſold. Of the laſt eighteen ſhips, eleven were broken up; of the reſt, two were loſt, one was burnt, and the remaining four were, I believe, ſold.

QUESTION 17.

What number of loads of rough timber are conſumed, on an average, in building an Eaſt India ſhip, in proportion to her tonnage, including plank and thick-ſtuff?

ANSWER.

I am not certain, but ſuppoſe, as iron is uſed for knees, &c. in thoſe ſhips, it may be about one load and a half to a ton.

QUESTION 18.

What proportion does the timber uſed in repairing an India ſhip, during the time ſhe continues in the Company's ſervice, bear on an average to the whole quantity uſed in her firſt conſtruction?

ANSWER.

The quantity of timber uſed in repairing Eaſt India ſhips, during the time they are in that ſervice, is quite uncertain: in general very little is uſed; for when their timbers are too *bad* to admit of being ſtrengthened with ryders, ſtandards, &c. the expence of ſhifting them is ſo great, that no ſhips lately have had *large* repairs, and it is not likely any will in future.

QUESTION 19.

What is your opinion of keeping a large ſtock of naval timber together in its rough ſtate for three years or more before uſing it?

ANSWER.

Keeping three years ſtock of timber, thick-ſtuff, plank, &c. in his Majeſty's yards is ſo obviouſly deſtructive of timber in general, and ſo extravagantly expenſive, that it is next to a miracle its having continued ſo long.

QUESTION 20.

If timber ſuſtains damage from being ſo kept, what proportion of it do you think may be thereby rendered unfit for ſhip-building?

ANSWER.

Rough timber piled together in ſuch vaſt quantities as is practiſed in the King's yards, and to remain in that ſtate for three years or more, muſt certainly receive much damage; but what proportion of it may be thereby rendered unfit for ſhip-building I cannot exactly aſcertain, it may be one third or more.

QUESTION 21.

How far do you think it practicable to mould timber for the various purpoſes of ſhip-building, at or near the places where it grows, before it is brought to the building yard?

ANSWER.

It may be done to great advantage, eſpecially where land carriage is expenſive.

QUESTION 22.

Would not that practice be the means of preſerving much timber that is now loſt by converſion in the dock yards?

ANSWER.

Certainly it would; and more eſpecially if converted by the contractors.

QUESTION 23.

In what degree or proportion is naval timber in general diminiſhed in quantity, it being converted from its rough ſtate into the proper forms for the purpoſes of ſhip-building; that is to ſay, How many loads of converted timber are produced from a certain number of loads of rough timber, on an average, in Square Meaſure?

ANSWER.

About one half in the merchants yards; but I ſuppoſe it to be much more diminiſhed in the king's yards: that is to ſay, two loads of rough timber will not, in the king's yards, produce one load of converted timber.

QUESTION 24.

What do you conceive to be the beſt method of preſerving timber in a converted ſtate?

ANSWER.

All converted timber, thick-ſtuff, plank, &c. ſhould be placed under cover, where there is a moderate current of air, as ſoon as it is received into the yards.

QUESTION 25.

Is there a greater difficulty in procuring oak knee timber now than formerly?

ANSWER.

I believe not. However great the difficulty has been, or may be at preſent, it is not of the ſmalleſt conſequence with reſpect to ſhip-building, as iron knees may be ſubſtituted in general to a much greater advantage.

QUESTION 26.

Is aſh timber, or the Spaniſh cheſnut, uſed for knees?

ANSWER.

None uſed that I know of, nor is there the leaſt occaſion for either.

QUESTION 27.

Are they found to anſwer the purpoſe, and to be nearly as durable as oak?

ANSWER.

I never had any experience of them.

QUESTION 28.

What ſubſtitute do you make uſe of when knee timber cannot be had?

ANSWER.

Iron is the beſt ſubſtitute.

QUESTION 29.

If iron be recommended, in what part of ſhips can it be uſed to advantage?

ANSWER.

ANSWER.

Iron may be uſed for hanging knees and ſtandards to all the decks, for all breaſt hooks (except the deck hooks), ryders, crutches, wing-tranſom and other tranſom knees, and for knees in general. I have had great experience of iron for many years, and am confident it may be uſed for the above purpoſes in all ſhips of war and other ſhips, to much greater advantage than wood.

QUESTION 30.

May not beech, elm, Dantzick, and Riga timber, ſupply the place of oak, in many parts of a ſhip? and if ſo, In what parts?

ANSWER.

Beech and elm may be uſed in all ſhips bottoms from the keel to the floor-heads. Dantzick plank may be uſed in the bottoms of all ſhips under the light draught of water in place of Engliſh oak; Riga and Quebec oak timber may be uſed in ſome parts of the navy, if there was a neceſſity from want of Engliſh oak. Foreign plank will be found to be as dear as Engliſh converted oak from the interior parts of this kingdom, the growth of which, even there, ought to be encouraged in preference to foreign oak, if it ſhould coſt more money, as being more durable and advantageous to the nation in general, and to the landed intereſt in particular. But I am firmly of opinion, there never will be a ſcarcity of oak timber in this kingdom, *if the King's foreſts and waſte lands were properly planted with oaks, and conſtantly taken care of afterwards.*

QUESTION 31.

Can you ſuggeſt any alteration in the manner of framing large ſhips, that would leſſen the conſumption of oak timber?

ANSWER.

By making the top ſides of all the King's ſhips (in future) to *tumble-home* very little. Alſo by *ſiding* the timbers of the frame leſs, and *moulding* them more. This would add ſtrength to the ſhips and leſſen the conſumption of timber.

QUESTION 32.

Have you ever conſidered the manner of framing ſlips or docks for building and docking large ſhips? and, Whether any means can be uſed to leſſen the quantity of timber made uſe of for ſuch purpoſes? or, Can you ſuggeſt any means by which either of them may be improved?

ANSWER.

Inferior timber being generally uſed for framing ſhips and docks, it is not very material as to the quantity made uſe of. But with reſpect to the mode of launching and docking ſhips in his Majeſty's yards, I am of opinion there is great room for improvement: and I beg leave to obſerve, that few things are ſo obviouſly abſurd, as the old method (which is at preſent practiſed in the King's yards) of launching ſhips on a curve line with ſhort bulgeways, and ſlices under each of them, and alſo with ſpurs, by which method it is impoſſible to launch any ſhip without *hogging*, and conſequently injuring them more or leſs. To prevent ſhips from receiving ſuch injury in future, I would recommend that their keels be put on blocks of ſufficient height, that the *ways* for launching them may be laid on a ſtraight line, with a declivity of near an inch to a foot for large ſhips, and of a full inch to a foot for the ſmaller claſs of ſhips. To have bulgeways as uſual (but fitted without either ſpurs or ſlices, as all King's ſhips are docked after they are launched to be coppered; a plank ſecured to the bottom at both ends of the bulgeways, to prevent the heads of the puppets from flying out, would be ſafer and much better than ſpurs). In addition to the bulgeways, to have ſliding planks or *ways* in the middle line, to receive the keel, from about 14 feet afore the ſternpoſt, and to be continued as low down as the launch is laid for the bulgeways, and to be of ſuch height as that the *fore foot* may run ſafely over it, and of the ſame declivity as the ſliding planks for the bulgeways. By this method it would be impoſſible that any ſhip ſhould receive the leaſt damage in launching; for when the blocks are all ſplit out from under the keel, the ſhip would be perfectly ſafe, and as well ſupported all fore and aft as when they were all under, and might remain in that ſtate until the next ſpring tides, or longer, if it ſhould be required, by want of water or any other cauſe.

The mode of docking large ſhips at Portſmouth, and other naval yards, by heaving them *an end* on the blocks with tackles when there is not ſufficient water to float them in, and alſo of raiſing them with wedges and ſhores in order to ſhift their keels, falſe keels, &c. when required, is certainly very abſurd, and the more ſurpriſing that it ſhould have continued to this time, when, by taking a view of the locks, &c. on the various inland navigations in this country, they would at once point out a more rational and much eaſier method of docking large ſhips, and raiſing them on blocks of ſufficient height for ſhifting keels, or doing any repairs that may be wanted, without the leaſt difficulty, by filling the docks with water to any height required, by means of a reſervoir ſufficiently large for that purpoſe, which may be always ſupplied and kept full by a ſteam engine, or otherwiſe, at a very ſmall expence, and to the greateſt advantage.

Had proper engineers been originally employed by Government for the general conſtruction of the docks in his Majeſty's ſeveral yards (who had previouſly ſurveyed and taken plans of all the naval docks in Europe) I am clearly of opinion they would have been much better conſtructed, and at a conſiderably leſs expence.

QUESTION 33.

Can you propoſe any better method of preſerving ſhips after they are built, than lying afloat at moorings?

ANSWER.

See the Anſwer to the Firſt Queſtion.

QUESTION 34.

Suppoſing an Eaſt India ſhip to lie ſome years under cover when building, and proper attention paid in that time to the ſeaſoning of her frame, and other timber, and leaving her treenail holes open, how long might ſuch a ſhip laſt either in years or voyages?

ANSWER.

Ships built under ſuch regulations may laſt from 12 to 15 years, and perform ſix voyages, with a ſmall expence for repairs; as ſhips built in a ſhort time with green materials, will coſt repairing for four voyages.

QUESTION 35.

Can you ſuggeſt any means by which the conſumption of oak timber may be leſſened in ſhip-building, or any improvement by which the duration of ſhips would be increaſed, and in which the expence would not exceed the value of the timber ſo ſaved? If you can, be ſo good as to ſtate it, or any other improvement whatever in the conſtruction or preſervation of ſhips in general that you may be able to ſuggeſt.

ANSWER.

Never to have more than one year's conſumption of timber in any of his Majeſty's yards.

No rough timber ſhould be kept in the weather longer than one year before it is converted; for timber laying in that ſtate, expoſed to wet and dry, receives more damage than is generally imagined.

All timber ſhould be converted as ſoon as received into the yards, and afterwards ſhould ſtand to ſeaſon in the ſhip's frame, under a roof ſufficiently large to cover the whole ſhip.

Timber ſhould alſo be ſpread abroad as much as poſſible, in order to lay the moulds readily upon the moſt proper pieces; by which method a great ſaving of timber would be made in the converſion, and alſo be of great advantage in point of ſtrength to the ſhips, as there would be no occaſion to uſe any timber, but what was of proper ſize and growth. It would alſo ſave the expence of piling, unpiling, &c. &c. as it is practiſed in his Majeſty's yards.

All timber deſigned for ſhips frames ſhould be contracted for, to be ſerved in the yards ready converted to their reſpective moulds, and the ſhips to be put on the ſtocks, and completely timbered within a certain time, and to have a ſhed built over them (to be included in the ſaid contract), and to remain in that ſtate to ſeaſon, during pleaſure, or until wanted, when each ſhip ſhould be completely finiſhed by another contract. All the beams, knees, thick-ſtuff, plank, &c. ſhould be provided as ſoon as the ſhip is in frame, and placed under cover, ſo as to have the ſame ſeaſoning; all thick-ſtuff, plank, &c. that requires to be boiled in the kiln, if it was afterwards placed on racks and burnt, ſo as to exhauſt the moiſture occaſioned by its being boiled, and alſo to bring it to its *round*, would be of great advantage to the ſhips.

Government ſhould have twenty or thirty ſail of line of battle ſhips, of 74 guns and upwards, conſtantly on the ſtocks (under proper cover) nearly finiſhed, or in ſuch ſtate that they may be launched in a ſhort time on any emergency; and ſhould have ſhips built for the Navy in private yards, in times of peace, &c. (as recommended in my firſt Anſwer).

I am of opinion, that all the rough timber now in his Majeſty's ſeveral dock yards ſhould be immediately converted into ſhips frames; and as many of them put on the ſtocks as all the timber in thoſe yards will produce: But if there ſhould not be a ſufficient quantity to complete all the frames ſo put up, let contracts be made with timber merchants, or others, to complete the ſeveral frames; and to build a roof over each of them, including every expence attending the ſame: By this means a great part of that unneceſſary ſtock of timber now in the King's yards would be preſerved, except ſuch as is already rotten or otherwiſe defective.

No ſhips ſhould ever have what is called *thorough repairs*, or *any* timbers ſhifted; but ſhould have temporary ſlight repairs, with iron ryders, ſtandards, &c. and to have new ſhips put on the ſtocks in their room, when neceſſary; as it is a well known fact, that many ſhips have coſt nearly as much repairing as *two* new ſhips of the ſame dimenſions and ſcantlings would coſt building. Perhaps this has been done on an idea of ſaving timber; but certainly it is a great miſtake. In building ſhips, the plank of the bottoms, inſide plank, &c. ſhould be partially bolted on, and all the treenail holes to be bored through, as ſoon as the plank is worked; but no treenails drove until the ſhip is nearly finiſhed, or ready for caulking; alſo to have the treenails well ſeaſoned before they are drove, and made of the beſt oak in the kingdom.

I am of opinion, that all the ſhips of the preſent Navy are too ſhort, from ten to thirty feet, according to their rates. And if ſhips in future were to be built ſo much longer as to admit of an additional timber between every port, and alſo if the foremoſt and aftermoſt gun-ports were placed a greater diſtance from the extremities, they would be ſtronger and ſafer, have more room for fighting their guns, and, I am perſuaded, would be found to anſwer every other purpoſe much better than the preſent ſhips of the Navy: And there would be no neceſſity of uſing long thick-ſtuff, and plank, for a three port ſhift in ſuch ſhips, as a two port ſhift would be ſufficient. \ The foremaſts of all the ſhips of the Navy are placed too far forward, from four to ſix feet. The ſhips are too lofty abaft, and too low in midſhips; they would be much better and ſafer, if their fore-caſtles and quarter decks were joined together; for if they carry *two*, *three*, or *four* tier of guns, *forward* and *abaſt*, they certainly ought to carry the ſame in *midſhips*, as it is an abſurdity, and alſo a great njury to any ſhip, to load the extremities with more weight of metal than the midhips. No ſhips, however ſmall, that have fore-caſtles and quarter decks, ſhould go o ſea with *deep waiſts*; they certainly ought to have *fluſh upper decks*.

Ships of the Navy are not ſufficiently ſtrong to carry the uſual weight of metal: On he whole, they have plenty of timber, but are every way deficient in iron to ſtrengthen nd connect the ſides and beams together, ſo as to prevent their working in bad wea-her, or long engagements, when they uſually break many of the fore and aft bolts of he knees, and the ſhips ſpread, ſo as to leave the ends of the beams ſhort of the ſides; o prevent which, they ſhould have iron hanging knees (with a greater number of fore and aft bolts than is cuſtomary for the ſhips of the Navy) to all the beams in the ſhip; alſo iron ſtandards, fayed to the decks (without ſhoels), between every port; and all the old ſhips of the preſent Navy ſhould have iron inſtead of wood ſtandards, and an additional iron hanging knee under every beam in the ſhip, where there is not a ſtandard; and alſo to have diagonal braces fixed to them as after mentioned.

All breaſt-hooks ſhould be of iron (except the deck hooks), alſo all the crutches and wing-tranſom, and other tranſom knees, and knees in general; as they are *lighter*, *cheaper*, and *ſtronger* than wood; and may be made to any ſize and length, ſo as to have any number of additional bolts.

All bolts of the knees, breaſt-hooks, and crutches, ſhould be drove from the inſide, and clenched on the outſide plank; and the bolts for all iron knees, ſtandards, &c. to have collar heads.——I particularly recommend diagonal braces to be fixed from the keelſon to the gun deck clamps; ſix or eight pair of them, well ſecured at each end with iron knees and ſtraps, to all the ſhips in the Navy, would effectually prevent their ſtraining and working in bad weather in the manner they now do.

The bottoms of all ſhips in the Navy are too thin: Ships of 74 guns and upwards ſhould have ſix inch bottoms, and no ſhip's bottom ought to be leſs than four inches thick, and the edges ſhould be rabbetted, ſo as to require little or no caulking. The wales and inſide ſtuff of thoſe ſhips are much too thick, and is an unneceſſary conſumption of oak timber: Wales, &c. eight inches thick, would be ſufficient for the largeſt ſhips in the Navy.

The capſtands throughout the Navy are fitted on a bad principle, as they require a much greater number of men than would be neceſſary, if they were fitted with an iron axis or ſpindle, as certainly all capſtands ought to be; and alſo with pall heads, and catch palls, to ſecure the whelps, and prevent the people from being thrown from the bars, which has frequently happened in the ſhips of the Navy, and many of their people have received much damage. The ſort of capſtand, with iron ſpindle, pall head, and catch palls, has been in uſe on board all the Eaſt India ſhips for a great number of years; and none of the ſpindles, or any other part of the capſtand, have ever failed, nor has the leaſt accident happened from them. Every capſtand in the Navy may be altered to the ſame plan, at a very trifling expence, conſidering its great utility.

All ſhips rudders ſhould be ſhort of the under ſide of the keel, from eighteen inches to two feet; and ſhould be hung in the center, and have a round head, to work in a circle, ſo as to require no rudder coat; and thoſe ſhips that have no roundhouſe, their rudders ſhould run up, and ſteer with a yoke abaft the rudder head, above the upper deck.

Cables are in general very much injured by ſmall ryding bitts and croſs pieces; and more eſpecially from the fore part of the bitts, and after part of the croſs pieces, not being made circular, or their edges rounded when new. A 74 gun ſhip's bitts, and their croſs pieces, are not more than 20 inches each, whereas thoſe of Eaſt India ſhips are two feet; and the fore part of the bitts, and after part of the croſs pieces, are ſo rounded, that the cables cannot be the leaſt injured by them. Laſt year one Eaſt India ſhip (the Woodford) had caſt iron rollers fitted to her bows, to eaſe the friction of the cables, in place of bolſters or naval hoods.

The heads and quarter galleries of all ſhips ſhould be reduced; and alſo the great overhanging of the ſterns.

All ſcuppers ſhould be of caſt iron, without having any lap on the deck or ſpirketting, as they cannot be *broke* by the working of the ſhip.

If the foregoing were put into execution in ſhips of war, I am certain they would be *much ſtronger*, *ſafer*, and *more durable*, than the preſent ſhips of his Majeſty's Navy; and they would alſo be able to keep the ſeas for years without docking.—I have no idea of a ſhip of war that is properly built *foundering*, or not keeping the ſeas in the *worſt weather*.

The fewer ſhips that are built for the Navy in future, not capable of mounting 74 guns and upwards, the better, as ſhips of 64, 50, and 44 guns, alſo ſmall frigates, ſloops, &c. conſume vaſt quantities of oak timber, are maintained at a great expence to the nation, and are by no means equally ſerviceable.

But I am of opinion (contrary to the ideas of ſome gentlemen) it would be for the intereſt of Government, and alſo of the Eaſt India Company, if they were to have twenty ſail of ſhips built for the China trade *(when new ſhips are wanted)*, that may be capable of fighting ſixty guns with a cargo on board them. They might carry eighteen pounder guns on their middle decks, and ſix or nine pounder guns on their upper decks; and, when deep loaded, would be able to keep their lower tier of ports open longer than any ſhips in his Majeſty's navy. Such ſhips, being more defenſible, would require a leſs number of ſhips of war to protect them, which would ſave the vaſt expence of convoys, and of ſhips being ſtationed in India, &c. in time of war. It would alſo be a great ſaving of oak timber, as the ſwift decay of ſhips ſtationed in India is very evident, and is a matter that ought to be particularly attended to.

I am farther of opinion, if the Company were to carry on their trade in general in large ſhips, they would not be ſo deſtructive to the growth of oak timber as ſmall ſhips; for if two ſhips were to be built of 600 tons each, and one of 1,200 tons, it would be found that the former (two) had conſumed near three-fourths more in number of oak trees than the latter, conſequently the ſmall ſhips would increaſe the conſumption of young growing timber trees, and tend greatly to prevent the growth and ſupply of large timber.

I have found on inquiry, that oak timber under forty feet meetings has increaſed in price, ſince the year 1771, about fifteen ſhillings per load, whereas timber of ſixty feet meetings has increaſed only five ſhillings per load, which is a proof there has been a greater demand for ſmall timber than for large; and if the conſumption of the former continues to be greater, it will (unleſs proper precautions are taken) ultimately cauſe a ſcarcity of the latter. But I am confident that more timber, large and ſmall, may be ſaved in future in his Majeſty's yards, and from what I have recommended reſpecting the Royal Foreſts, &c. than will be required for the conſtant building and repairing a neceſſary number and tonnage of ſhips for the Eaſt India Company's ſervice.

After taking care to plant and improve the *King's Foreſts* and *Waſte Lands* to the greateſt advantage, I farther recommend, that Government particularly attend to the ſhipwrights in their own yards; for at preſent they are much too low in eſtimation, and too few in numbers; and if there is not a greater number brought up and kept in the King's yards, it is probable the Navy, and of courſe the nation, will receive a ſevere check, whenever there may be a neceſſity of fitting out a fleet on any emergency.

Their pay was probably ſettled at two ſhillings and one penny per day in Charles the Second's time, which is now as low as the pay of a common labourer in the merchants builders yards in the River Thames, who are at no expence for tools, &c. This pay is certainly too low for any artificer that has ſerved an apprenticeſhip, and particularly ſo for ſuch a valuable body of mechanics as the ſhipwrights are to this nation; for if they are too few in numbers, *that* muſt greatly impede the equipment of a fleet, and increaſe the expence of the nation, *far* above that of maintaining and keeping half as many more in his Majeſty's yards in time of peace, even if they were allowed half a crown a day, which at this time is very moderate, and by no means in proportion to their pay at the time it was firſt ſettled. There are always many ways of employing ſhipwrights in the King's yards, if there ſhould not be ſufficient work in their own line to employ them; but no other mechanics can be ſubſtituted in *their* room, if there ſhould be a deficiency in numbers of *them*.

And I farther beg leave to obſerve, from the previous obſervations and recommendations herein contained, together with what was ſuggeſted by me on the ſame ſubject, and printed with the Report of the Committee of the Houſe of Commons in 1771, that Government have the power not only to double the growth of oak timber in the foreſts and waſte lands, but alſo greatly to reduce the conſumption of oak timber for building and repairing the Navy. This, with the ſupply that may be obtained, at very reaſonable rates, from the uſual annual falls of private gentlemen's timber, would (except from miſmanagement) effectually prevent the want of that article for the Navy in future.

Eaſt India Houſe,
May 12th, 1791.

GAB. SNODGRASS.

EVIDENCE *given by Mr.* SNODGRASS *before a* COMMITTEE *of the* HOUSE *of* COMMONS, *appointed in March* 1771, *to conſider how his* MAJESTY'S NAVY *might be better ſupplied with* TIMBER.

AFTER having recited the evidence of ſeveral reſpectable ſhip-builders and timber merchants, the Committee then proceeded to examine Mr. Gabriel Snodgraſs, Surveyor to the Eaſt India Company; who ſaid, that after he had ſerved his apprenticeſhip to Mr. Snell, a builder's meaſurer in one of the King's dock yards, he became a working ſhipwright there; was then recommended by Mr. Benjamin Slade into the ſervice of the Eaſt India Company, and went to Bengal as their ſhipwright, and had the ſuperintendency of all the Company's ſhipping at that place; that he has been their Surveyor in England ever ſince the year 1757, and has been converſant in ſhip-building ever ſince he became a ſhipwright, and particularly attentive to the breaking-up of ſhips of war, foreign as well as Britiſh. And he delivered in, to your Committee, a paper containing his general ideas with reſpect to the promoting the growth and reducing the conſumption of oak timber; a copy of which paper is as follows, *videlicet:*

" In the firſt place, I am of opinion, that the foreſts and waſte lands belonging to the Crown may be made, in thirty or forty years time, capable of producing a regular ſucceſſive ſupply of timber ſufficient for the Royal Navy.

"I am alſo of opinion, that there is yet plenty of large timber within forty or fifty miles of water carriage; and in the interior parts of the kingdom great quanties of large timber; and that it is in the power of Government to manage the ſupplies from each county ſo as to encourage its growth all over the kingdom, and thereby render it highly improbable ever to be in want of large or ſmall timber for the Navy, without circumſcribing the conſumption of any ſort; for that would aſſuredly greatly diſcourage the growth of timber in general: But if any doubts remain, the Lords Lieutenants and the landed Gentlemen may, in the courſe of this ſummer, inform Government what quantity of large timber is growing in each county.

" With reſpect to the conſumption of oak timber, I am of opinion, that three men of war may be built in the merchants yards with little more timber, and at as little expence, as two are built in the King's yards; but I do not mean to ſay, it is a right meaſure to build or repair King's ſhips in the merchants yards, for, I firmly believe, that mode has greatly raiſed the price of building merchant ſhips, as well as the price of timber in general; and ſure I am, that there are people in the King's yards as capable of building ſhips as cheap and as good as thoſe built in the merchants yards, if they had the ſame encouragement. I am alſo of opinion, that much timber might be ſaved by a little alteration in the conſtruction of the topſides of the King's ſhips; and in my opinion would be attended with great utility to 74 gun ſhips.

" I ſhall next proceed to the preſervation of ſhipping in general: And here I would recommend all ſhips to be built under the cover of a roof; that the King's ſhips be built in docks under a roof; never to be floated out before they are wanted for ſervice; and on their return, when no further ſervice is required of them, to be laid up in thoſe docks again. That as the expence of the gates, &c. is the moſt material, I would recommend the lengthening the preſent docks; and this may be done ſo as to require but few new gates to be made, even for the whole Navy of England, and would ſave all the expence of mooring, the ordinary, &c. &c. and cauſe the ſhips in the Navy to laſt and continue ſound at leaſt half as long again as they do at preſent, and ſave the expence of four inch plank, with the money expended in repairing the damage done to the bottoms by the worms, as I have been informed the Triumph, and ſeveral of the new ſhips bottoms in the River Medway, have lately been much injured by them; likewiſe the annual caulking, painting, and repairs, &c. &c. would be ſaved.

" Now with reſpect to the Eaſt India Company's ſhips: the old ones now in their ſervice are built ſlighter, in proportion to their tonnage, than any other merchant ſhips in the River Thames; they are too narrow for their depths, which muſt be maintained, on account of their ſtowage in the hold, and the neceſſary height between decks. Nothing but the conſtant repairs, attended with great expence, has

“ made them tolerably ſafe for four voyages; it was therefore highly neceſſary, for “ theſe and many other reaſons, to build ſhips ſtronger and broader; and, conſe- “ quently, the ſhips built latterly, I am of opinion, will run five or ſix voyages with “ much leſs conſumption of timber, as well as expence in repairs, than the old ſhips “ run three and four voyages; they alſo ſail cheaper, and conſume a conſiderable “ leſs number of oak trees in proportion to their tonnage; they are ſafer, ſtiffer, “ and much more defenſible; they are more healthy for the ſeamen and recruits; “ are alſo very advantageous to the Company in reducing their freights, by means “ of the additional ſurplus tonnage brought home on half freight, which enables the “ Company to lower the price of their teas, ſo as to prevent the ſmuggling that article “ from abroad in ſo great a latitude. Other nations are ſo ſenſible of theſe advan- “ tages, that they trade in much larger bottoms than any in the Company's “ employ.

“ And with reſpect to their ſcantling, ſo much has been ſaid to the Committee of “ the Honourable Houſe of Commons relative thereto, that I need only obſerve, it “ appears to me many gentlemen have formed wrong ideas on that head, partly “ owing to their having been compared to ſixty-gun ſhips, &c.; and therefore, in “ order to ſet this matter in the cleareſt light, I beg leave to obſerve, that although one “ of the largeſt Eaſt India ſhips carries, both outward and homeward-bound, as much “ tonnage to ſea as a ſixty-four gun ſhip, and homeward-bound their cargoes are “ often ſix times the value of a ſixty-four gun ſhip, yet two of them were built for “ 10l. 10s. per ton each: a ſixty gun ſhip coſts, even in the merchants yards, “ 16l. 12s. 6d. per ton; and the difference of building each ſhip is as follows, “ *videlicet*,

“ 1 India ſhip, 864 tons, at 10l. 10s. per ton, 9,072l. Five ſhips is “ 45,360l.

“ 1 Sixty-four gun ſhip, 1396 tons, at 16l. 12s. 6d. per ton, 22,759l. Two “ ſhips is 45,518l.

“ The above ſixty-four gun ſhip is ſuppoſed to be built in the merchants yard; if “ the compariſon was made with a ſixty-four gun ſhip built in the King's yard, then “ it would appear that three of the largeſt ſhips in the Company's ſervice did not coſt “ ſo much building as one ſixty-four gun ſhip. By this, I preſume, it will appear “ impoſſible for their ſcantling to be nearly equal; and part of the ſhips now building, “ although 758 tons builders tonnage, and who will carry to ſea 1200 tons, their “ principal timbers are not ſo much ſided as a thirty-two gun ſhip of war, nor are “ larger than thoſe propoſed by Mr. Randall for a ſix hundred ton ſhip. This is “ owing to the builders being allowed to make their own contracts, which is a “ great indulgence, conſidering the advantages ariſing to them by repairs; yet ſome “ of the gentlemen builders are more moderate than others; and it gives me pleaſure “ to obſerve, Mr. Randall propoſes a four-inch bottom for his ſix hundred ton ſhip, “ and gives juſt reaſons for the ſame: indeed I have heard three-inch bottoms had “ been propoſed; but I judged humanity would not ſuffer any man to alter that great “ improvement in the Company's ſhips; as knowing the great additional ſtrength “ and ſafety added thereby. I am alſo of opinion many ſhips have been loſt with a “ three-inch bottom that a four-inch bottom would have ſaved; and am confident “ it will be the cauſe of ſaving much timber, not only in repairs, but by enabling “ them to go a greater number of voyages. All ſhips of 500 tons and upwards “ ſhould have four-inch bottoms; for it is a known fact, that no nation builds with “ ſo thin bottoms, or makes uſe of ſo thin ſheathing, as the Engliſh; and if the “ Company were to allow the captains and officers money in lieu of privilege in trade, “ it would further prevent ſmuggling and interfering in the Company's trade; and “ were they to build their own ſhips, it would not only be a very great ſaving in their “ freights, but one half of the quantity of timber now conſumed in building and “ repairing would be then ſufficient, for there is now 61,000 tons of ſhipping in the “ ſervice, whereas, if the above ſcheme was adopted, 40,000 tons would, in my “ opinion, be full ſufficient; and as the ſhips would in general go out the ſeaſon after “ their arrival, they would make ſix voyages nearly in the ſame number of years “ that they are now making four voyages.—I forgot to mention in its proper place, “ that it appears to me the price of ſmall timber and the building ſmall ſhips has ad- “ vanced full as much or more than large timber and the building large ſhips, and that it is my opinion the building ſmall ſhips is more prejudicial to the growth of timber than the building large ſhips.

“Permit me the liberty of obſerving here, that the before-going obſervations do not ariſe from any intereſted views to myſelf, as I never had, nor do I ever expect, any emolument myſelf from either large or ſmall ſhips, more than the ſalary allowed me by the Company; and this I remark to ſave the trouble of aſking queſtions relative thereto.

“GAB. SNODGRASS,
“Surveyor of Shipping to the Honourable Eaſt India Company.”

“Eaſt India Houſe, the
“22d April, 1771.

He likewiſe gave in another paper, being a Copy of a Repreſentation made by him to Mr. Purling when he was Deputy Chairman of the Eaſt India Company; a copy of which is as follows, *videlicet*,

“SIR,

“YOU deſire my thoughts, not only on the Company's ſhips but on ſhipping in general; what methods I would propoſe to prevent their decaying in ſo ſhort a time, how to leſſen the conſumption and aſſure a conſtant and regular ſupply of oak timber for building them; as likewiſe if it is a real fact, that large oak timber and large ſhips are dearer now in proportion to their tonnage than ſmall ſhips and ſmall timber, taking the prices of laſt war to compare by; and if any of the Eaſt India Company's ſhips that have been lately built, are likely to conſume more timber in repairs than the old ſhips have; or if they conſume more timber in building them than the men of war do, in proportion to each ſhip's real tonnage, taken from their greateſt loaded draft of water; or if I can think of any method of leſſening the preſent conſumption of timber in the India ſervice in particular: to all which I ſhall reply to the beſt of my judgment and recollection, without conſidering any thing foreign to the above. In the firſt place, I would build all ſhips with winter-fallen timber, under the cover of a roof ſufficiently large to ſhelter them entirely from the weather while building; and never launch or float them, or drive any tree-nails in them (or very few), before they were intended for ſea; and at their return, if they are to be laid up, or require any conſiderable repairs, I would have proper docks, all covered over, to receive them; then I would take out all the ballaſt, ſcrape, waſh, and clean them, and give them all the air poſſible, and continue them in the ſaid docks until they were wanted to proceed to ſea: I would conſtruct or form all ſhips ſo as to require the leaſt compaſs (*alias* large grain cut) timber poſſible, and make uſe of no oak for orlope beams, &c. or wherever I could ſubſtitute fir or elm, &c. with propriety in the room of oak. I would likewiſe convert all the timbers in the ſhips as near a ſquare as poſſible, that no ſtrength might be loſt by reducing them too much the moulding way, which is too frequently done to the great prejudice of ſhips in general; and I would alſo increaſe the thickneſs of the plank of moſt ſhips bottoms, and rabbet the ſame, and diminiſh the inſide plank in proportion; I would have no ſhips built, or timber bought and converted to building, but by thoſe who are to pay for their own bad management, both in purveying and converting, throughout the whole. Let the foregoing be put in practice, and one half of the conſumption and decay of oak timber will be ſaved, if not more. Now, Sir, in order to aſſure a conſtant ſupply of oak timber for the navy for ever, I would plant ſuch parts of all the King's foreſts that are capable of growing oaks and not already planted, and incloſe the ſame to prevent the cattle from injuring them while young; and cauſe large penalties to be laid on any one that ſhould cut down or injure ſuch oaks, &c.: and if, on a ſtrict ſurvey, the whole of the crown lands ſhould not be thought ſufficient, I would purchaſe other wood and waſte lands (on the clays, that ſoil being beſt) as ſhould be judged neceſſary, and incloſe and plant, &c. as before-mentioned, and cut no timber trees down before they were nearly at their full growth, but purchaſe timber of private gentlemen ſo long as the ſaid plantations made it neceſſary; by this means a regular and ſure ſupply of oak timber might be provided for ever. You next deſire to know, if large oak timber and large ſhips are dearer now than ſmall ſhips and ſmall timber? I anſwer, No; but rather the contrary; for ſmall ſhips, and conſequently ſmall timber, hath raiſed in price conſiderably more than large ſhips ſince laſt war. See the Navy Contracts for frigates and ſeventy-four gun ſhips. Your next queſtion is, Whether the late ſhips built for the Eaſt India Company's ſervice are likely to conſume more timber in repairs than the old ſhips uſually have conſumed? I anſwer, No; that it is almoſt impoſſible; for I firmly believe thoſe lately built on the beſt of the two plans will run ſix voyages, if permitted, coſt leſs money, and conſequently leſs timber in repairs, than the old ſhips have done, on an average for forty years paſt, for four voyages. You next aſk, If the preſent India ſhips conſume more timber than men of war in proportion to their tonnage, taking each at their greateſt loaded draft of water? No; ſo far from it, I am of opinion, that every load of oak timber converted for building ſuch India ſhips, do carry to ſea double the real tonnage that the like number of loads of oak do that is converted in the King's yards for building of men of war. You likewiſe deſire to know if I can think of no method to reduce the preſent conſumption of oak timber in the India Company's ſhipping? I anſwer, that this may eaſily be done with conſiderable advantage to the Company (by two methods): The firſt is, not to build any more ſhips until their number is reduced ſo as to have none lay by waiting for their turns a whole ſeaſon; for it is better to have rather too few than too many, as a ſupply may eaſily be had on any emergency; and then each ſhip might make eight voyages in twelve or fourteen years in the room of four voyages, and the tonnage of ſhipping by this means reduced from ſixty to forty thouſand tons; this would ſave more than one half of the timber now conſumed. The next method I propoſe is, to build ſhips ſufficiently large to cope with the French Eaſt India ſhips, by which means few or no men of war would be required to protect them; conſequently the timber uſed for building ſuch men of war would be ſaved; and for which, in the end, they are ſure to pay four times as much as it would coſt the Company to protect themſelves; for large ſhips are not only more defenſible but more healthy, and conſume a conſiderable leſs number of oak trees, but likewiſe ſail cheaper in proportion than ſmall ſhips do; and a very amazing ſaving to the Company alſo ariſes by ſurplus tonnage. Other nations know this full well, and proceed on theſe principles. I know great cry has been raiſed againſt building large merchant ſhips, and many gentlemen believe this to be the reaſon that large timber is ſo ſcarce; whereas it is quite the contrary, as muſt appear when it is conſidered that very few large merchant ſhips have been built; therefore it muſt be the great demand for ſmall timber in ſhipping and all other branches of conſumption, that has tempted the landed gentlemen to cut down ſo much timber before it comes to its full growth; and if theſe meaſures are continued, a real ſcarcity of large timber muſt enſue in a few years; which now may be prevented, not only by the foregoing meaſures, but by repealing all acts of parliament that tend to encourage the conſumption of oak timber in general, ſuch as not allowing foreign bottoms to be made free without a very conſiderable expence, &c.; and by making other acts to prevent foreigners building and repairing ſhips, or otherwiſe making uſe of oak timber for foreign ſervice. And laſtly, I would encourage building ſhips in any part of the world ſooner than diſcourage the landed gentlemen in the bringing their oaks to maturity by only leaving open one market for large timber (that is, the King's yards), or ſooner than diminiſh the ſize of a ſingle merchant ſhip, eſpecially ſuch ſhips as muſt carry great numbers of troops long voyages, and in time of war are ſure to meet the enemy's merchant ſhips much above their match. *Le Bourdenaye* and the loſs of *Fort St. George* ſhould never be forgot.

"Since I received your firſt commands, I have heard a bill is depending in the Honourable Houſe of Commons tending to reſtrain the Honourable Eaſt India Company's ſhips to ſo ſmall a burthen as 600 tons: I therefore, as a ſervant of the Company's, beg leave to obſerve, that this, if it paſſes into a law, will, as I conceive, not only be prejudicial to them but to the nation in general, and the people's health. I therefore preſume it merits the attention and cool deliberation of the Legiſlature; and as there is no neceſſity for granting leave to build any more ſhips for the India ſervice for ſome years to come, they may, if they and you pleaſe, take any time to deliberate on this moſt weighty affair, which is a very lucky circumſtance; for the Government now occupy moſt of the principal merchants yards with their old and new ſhips, a meaſure that has always been very prejudicial, not only to the Honourable Eaſt India Company, but to the Go-

“ vernment and all owners of merchant ſhips. Before I conclude I muſt beg leave to obſerve, that ſo little do the Honourable Eaſt India Company's ſhipping merit any reſtraint on account of conſuming large timber, that the owners of ſuch ſhips are permitted, and do build them with ſo ſmall ſcantling, that their principal timbers are leſs than the principal timbers of the King's frigates, although they carry to ſea more than double their tonnage, and homeward-bound are often more than ten times their value.

“ I am, Sir,
“ Your moſt obedient humble ſervant,
“ GAB. SNODGRASS.

“ Eaſt India Houſe, the
“ 12th March 1771.

“ JOHN PURLING, Eſq.”

And being aſked, What were the grounds of his opinion expreſſed in his firſt paper, “ that in 30 or 40 years the foreſts and waſte lands belonging to the Crown may be made capable of producing a regular ſucceſſive ſupply of timber ſufficient for the Royal Navy; and that there is yet plenty of large timber within 40 or 50 miles of water carriage; and in the interior parts of the kingdom great quantities of large timber?” he ſaid, That he was not concerned in the purchaſe of timber, his office being only to ſurvey the building of ſhips for the ſervice of the Company, and to take care that they are built according to the directions of the Committee of Shipping; but that his opinion is formed from the converſation which he has had with timber-merchants, ſhip-builders, and various other perſons who have travelled about the country.

He was then aſked, Whether he knew the Company entertained any idea of building no new ſhips till the general tonnage of their ſhips ſhould be reduced to 40,000 tons? he ſaid, That he did not; and that his opinion upon that point was founded on the Company's not ſending out more than 20,000 tons a year (builders meaſurement); that, whether the Company were to build ſmaller or larger ſhips than thoſe mentioned in his paper, they would ſtill have the ſame comparative advantages over ſhips of war in reſpect of carrying burthen; generally about three-fourths more than their meaſure: that the ſhips of war, from their light draught of water when launched to their general deepeſt draught of water, carry for the moſt part the ſame as the builders meaſure amounts to.

That the large ſhips now built for the Company with four-inch bottoms will go, each of them, one or two voyages more than the ſmaller ſhips they had before; that a reduction of the tonnage of each ſhip would neceſſarily increaſe the number of the whole, and cauſe a greater conſumption of young timber; that, under the preſent regulations of the Company, the captains are not obliged to employ more ſeamen in each ſhip than formerly; that two ſhips of 750 tons each, varying little in their maſts and yards from ſmaller ſhips, might be navigated with a leſs number of ſeamen than three ſhips of 500 tons each, and would better tranſport the ſame number of ſoldiers, and tend more to the preſervation of their healths, becauſe the ſmaller ſhips cannot allow a ſufficient height between the decks; that ſince the Company have made uſe of large ſhips with four-inch bottoms (which is about three years), he does not know that any accident of conſequence has happened to them, but remembers ſeveral to have happened before; that other European nations uſe larger ſhips in their India trade than we do, and would therefore in time of war have great advantages over us; that the large ſhips, armed and manned as they now are, can make a better defence than the ſmaller ſhips which were in uſe before, though not yet ſufficient to encounter the foreign ſhips; that the guns which the captains of the Engliſh Eaſt India ſhips are directed by the Company to carry, are nine pounders; but ſome of the large ſhips generally carry twelve pounders.

Mr. John Brent, Deputy Surveyor to the Eaſt India Company, confirmed the evidence of Mr. Snodgraſs in every particular.

No. 6.

Gentlemen,

Kent Road, January 17th, 1792.

WE are favoured with your letter concerning the expence of incloſing land in the New Foreſt, for the purpoſe of raiſing timber; and having taken the ſame into conſideration, we are of opinion that a fence, conſiſting of poſts and two rails, with a ditch five feet wide at top, and three feet deep, reduced equally on both ſides to one foot at bottom, all the earth thrown on the inſide to raiſe a bank two feet ſix inches higher, thereby forming a bed for quick, will be ſufficient to protect the incloſures from all kind of cattle, except deer, and be completed for three ſhillings per rod, excluſive of rough timber. Suppoſing the incloſures to be upon an average one mile ſquare (or 640 acres) will amount to ſix ſhillings per acre. If it ſhould be thought proper to protect the incloſures againſt deer, not only the firſt expence will be conſiderably increaſed, but the future repairs will be far more, as the quick will not be ſufficient at any time to protect the plantations from thoſe deſtructive animals.

Should the Commiſſioners think proper, we ſhall be willing, at any time, to engage to incloſe and plant the intended incloſures, and keep them in repair for any number of years, in any manner that ſhall be moſt agreeable to the Commiſſioners.

We are, Gentlemen,
with great Reſpect,
Your moſt obedient,
humble Servants,
A. and W. DRIVER.

Commiſſioners of the Land Revenue.

No. 7.

EXTRACT of a Letter from the Commiſſioners of the Navy to the Commiſſioners of the Land Revenue. Dated Navy Office, 18th May 1789.

IN order that our Anſwers to your ſeveral Inquiries, relative to the price of naval timber, and the building and duration of ſhips, may be the more diſtinctly underſtood, we ſhall tranſcribe the Queſtions from your Letter, and place the Anſwers oppoſite to them reſpectively.

QUESTION 1.

Is the price of great oak timber increaſed, and how much, ſince the year 1771?

ANSWER.

No addition has been made to the price of the timber; but to encourage the merchants to bring timber from the diſtant inland counties to the King's yards, a certain proportion of the extra expence of carriage has been allowed to the contractors, as will appear by the incloſed papers.

QUESTION 2.

If it has not much riſen in price, notwithſtanding the increaſed demand for it, for the Navy and for trading ſhips, to what cauſe do you impute there not having been a greater advance in the price?

ANSWER.

To the encouragement given to the merchants to bring timber from the inland and remote parts of the country, by the allowance paid for long carriage, and to the great improvements in the roads and inland navigation within a few years paſt, which have occaſioned the bringing to market immenſe quantities of timber, which could not otherwiſe have been brought to the dock yards but at an expence far exceding its value.

QUESTION 3.

Has the price of ſhips built for the navy in private dock yards riſen, and how much, ſince 1771?

ANSWER.

The price has riſen from 17l. 5s. to 17l. 17s. 6d. per ton for ſhips of third rates, and from 11l. 11s. to 11l. 15s. per ton for ſhips of ſmaller burthen.

QUESTION 4.

Is there any and what difference in the duration of ſhips of war built in the royal dock yards, and of ſhips built by contract or purchaſed?

ANSWER.

In general it is found that the ſhips built in the King's yards laſt much longer than thoſe built by contract or purchaſe; but the preciſe difference of their duration cannot be aſcertained, as it depends on a variety of circumſtances extremely contingent in their nature and not eaſily deſcribed. We are however of opinion, that 15 years may be allowed for ſhips built in the King's yards, and 10 for thoſe in the merchants yards.

QUESTION 5.

What is the cauſe of ſuch difference, if any? And what do you conſider to be the duration of each, at a medium, according to the modes of building hitherto uſed?

ANSWER.

The difference may be attributed principally to two cauſes; 1ſt. To the timber uſed in the King's yards being better ſeaſoned, and the iron work of a better quality; and, 2dly, To the ſhips being in general better built, the work more cloſely inſpected during its progreſs, and the ſhips a longer time in building, than in the merchants yards; which laſt circumſtance alone contributes greatly to their duration; but the merchants being employed to build ſhips of war only in caſes of emergency, are often, from the urgency of the ſervice, preſſed by the Navy Board to complete them in a ſhorter time than ſpecified in the contracts; and for want of a ſufficient ſtock of timber on hand, they are obliged, at a ſhort notice, to provide ſuch as they want, and to work it up before the juices are ſufficiently exhauſted to render it fit for uſe.

QUESTION 6.

If you can ſuggeſt any improvement by which the duration of ſhips would be increaſed, ſo as to leſſen the quantity of timber neceſſary to ſupply the dock yards, and in which the expence would not exceed the value of the timber ſaved, be ſo good as to ſtate it.

ANSWER.

Sundry experiments for this purpoſe have been tried, and others are now in preparation. The Montague, of 74 guns, was built in the year 1779, with winter-felled timber; but that ſhip not having come under ſuch a repair as required a complete examination of her condition, we cannot yet ſpeak with certainty of the effect. We have now ſtanding ſome trees ſtripped of their bark two years ago, in order to try the experiment of building one half of a ſloop of war with that timber, and the other half with timber felled and ſtripped in the common way. The ſeaſoning of the timber before uſing it, and letting the ſhips ſtand in frame a ſufficient time for ſeaſoning the ſeveral parts during the building, and the late introduction of fire-ſtoves to air the ſhips building, and thoſe lying up in ordinary, contribute greatly to their duration; and if ſhips were built under cover, and roofs continued over them while they remain on the ſlips, it would be a means of rendering them ſtill more laſting: and we are of opinion that the ſaving in the value of the timber by theſe methods will far exceed the expence of putting them in practice.

QUESTION 7.

Has Government any competitor in the purchaſe of great oak timber beſides the Eaſt India Company?

ANSWER.

We do not know of any other for ſhip building; but it has been mentioned by ſome of the timber merchants of the inland counties, that a great deal of large oak is bought by coopers, who give a much better price for it than is allowed by Government; and that a ſerious deſtruction of fine timber ariſes from this cauſe.

QUESTION 8.

As we underſtand that aſh timber and Spaniſh cheſnut have been uſed in the dock yards for ſome purpoſes in ſhip-building inſtead of oak, we beg to know if they have been found to anſwer the purpoſes to which they have been applied, and if they have proved to be nearly as durable as oak?

ANSWER.

No experiments of this kind have as yet been made in the dock yards, but the ſubject has been under our conſideration, and pieces of aſh timber and Spaniſh cheſnut are now collecting for making ſuch experiments, owing to the ſcarcity of oak timber.

QUESTION 9.

If you know the common duration of Ruſſian ſhips of war built of larch or larix timber, be ſo good as to ſtate it.

ANSWER.

We do not; but having a Ruſſian-built ſhip lying up in ordinary at Sheerneſs, which was built at Archangel about nine years ago, we have, on this occaſion, directed the officers of that yard to make the beſt inſpection they could of her a-float, and herewith ſend you a copy of their report.

The officers ſtate this veſſel to be as well kneed, with knees formed from the roots of the fir tree, as any ſhip they ever ſaw.

QUESTION 10.

As the larch will grow on ſoils unfit for oak, is it your opinion that the planting of that tree ſhould be encouraged, with a view to the ſupplying the navy with ſuch articles as may be furniſhed from that ſpecies of timber?

ANSWER.

We have had no experience reſpecting larch timber other than in the inſtance of the Ruſſian-built ſhip above-mentioned.

We are, &c.
CHAS. MIDDLETON.
J. HENSLOW.
GEO. MARSH.
GEO. ROGERS.
WILL. CAMPBELL.
E. LE CRASS.
SAM. WALLIS.

Sheerneſs, May 6th, 1789.

Honble Sirs,

In obedience to your direction to examine the ſtate of the frame, &c. of the Proſperity receiving ſhip, we have bored, ſpotted, and examined her in the beſt manner we can a-float; and herewith incloſe you an account of the ſame.

The beams, clamps, and knees in general appear ſound, and ſhe is as well kneed, with knees formed from the roots of the fir tree, as any ſhip we ever ſaw.

The plank on the topſide, ſpirketting on the ſpar deck, and timber heads, are in many parts very rotten; and although the ſtuff is ſound on the ſurface, is decayed next the timbers.

We are, &c. &c.

WILL. RULE, THO. MITCHELL.

(Atteſted)
Geo. Marſh.

Honble Navy Board.

No. 8.

EXTRACT of a Letter from Samuel Pepys, Eſquire, Secretary of the Admiralty, to the Commiſſioners of the Navy, dated 28th October 1687.

I HAVE another Paper of much more moment to communicate to you, as wrote upon a ſubject of a much more extenſive and laſting conſequence to the Navy, if the contents of it ſhall, upon proof, be found anſwered: It is a diſcourſe lately wrote by the learned Dr. Plott, for the ſatisfaction of his Majeſty, touching the moſt ſeaſonable time for felling of timber, occaſioned by ſomething I had obſerved by him ſaid in a Hiſtory by him lately wrote of Staffordſhire; where, and in ſome of the neighbouring counties, the method he here propoſes has (it ſeems) time out of mind, and remains at this day, the vulgar method of felling timber for buildings; to which (ſince the date of this) he tells me he has, by a later inquiry, found this to be added, that the ſame courſe is taken on all like occaſions in Yorkſhire and other our northern counties, out of which the principal timbers being ſaid to have been fetched that made up the frame of the Royal Sovereign, he ſeems inclined to think, that the extra degree of laſtingneſs viſible at this day in ſome of the beams extant of the original fabric of that ſhip may moſt reaſonably be imputed. But how far you ſhall allow of that inference, when you come to read his diſcourſe, I ſhall not venture to foretell: But the King is ſo far diſpoſed to the giving credit to the propoſal, that it is by his command that I herewith tranſmit it to you, recommending it from him to your ſerious and joint peruſal; and (unleſs you find any very cogent reaſons to the contrary) to your taking the firſt opportunity you can, whether upon the next parcel of trees you ſhall have to fell for the Navy out of the King's own woods, or of what you may be able to get an occaſion of trying it upon any merchant's goods you ſhall contract for, while the trees are ſtanding, of informing yourſelves, by an actual experiment of your own, of the efficacy or imperfection of the doctrine propoſed; with which, and the deſiring your returning to me the paper I now ſend you, when you ſhall have peruſed it, together with your opinion upon it, to be communicated to the King, is all I have now to trouble you with. Remaining,

Your moſt humble ſervant,

S. PEPYS.

A DISCOURSE concerning the moſt Seaſonable Time of Felling Timber; written by the Advice of the Honourable SAMUEL PEPYS, Eſq. Secretary of the Admiralty, for the uſe of His Majeſty, by ROBERT PLOTT, L.L.D. 1687.

May it pleaſe your Majeſty,

WHEN I firſt imparted to your Majeſty the manner of felling of timber in the county of Stafford, with the advantage it might give to your Royal Navy were all the timber uſed in building your fleets ſo felled, according to your Majeſty's command, I immediately (the ſame day) waited upon Mr. Secretary Pepys and Sir Anthony Deane, and communicated the matter to them, who both promiſed me they would acquaint your Majeſty I had ſo done, and give your Majeſty an account of their preſent thoughts of it; but the former, viz. Mr. Secretary Pepys, received ſo ſtrong an impreſſion of the uſefulneſs of the experiment, and thought it (after conſideration) of that importance, that he deſired me the day following farther to conſider this ſubject, and ſee what might be added to what I had already written in my Hiſtory of Staffordſhire relating to it, and what material objections made, why this cuſtom of Staffordſhire, and the neighbouring counties, might not be practiſed here in the ſouth of England, as well as there; and to put all into writing for your Majeſty's uſe.

For the performance whereof with as much brevity as perſpicuity will allow me, your Majeſty is firſt deſired to recollect what I told your Majeſty in May laſt, that the cuſtom of felling timber here in the ſouth of England differs from that of Staffordſhire only in two things, viz. in the time of felling, and manner of barking; it being felled here in the ſpring, as ſoon as the ſap is found to be fully up, by the trees putting out, and then bark't after the trees are proſtrate, the ſap yet remaining in the bodies of them: Whereas there it is firſt bark't (in the ſpring as here), but before it is felled, the trees yet ſtanding, and living all the ſummer, and not felled till the following winter, when the ſap is fully retired: Whether of which cuſtoms of felling timber either for ſhips or other buildings, is moſt eligible, is the point to be diſcuſs't.

In the clearing whereof may it pleaſe your Majeſty firſt to take notice, that all trees in the ſpring ſeaſon (when uſually we fell them in the ſouth of England) and ſome time after are pregnant, and ſpend themſelves (as animals do in their reſpective offſprings) in the production of leaves and fruits, and ſo become weaker than at other times of the year, their cavities and pores being then turgid with juices or ſap, which (the tree being felled at that time) ſtill remains in the pores (having now no manner of means to return), and there putrify, not only leaving the trees full of cavities, which render the timber weak, but ſecondly breeding a worm (as both Pliny and Mr. Evelyn teſtify) that will ſo exceedingly prejudice it, that it becomes altogether unfit for ſtrong incumbencies, or other robuſt uſes. Thirdly, that all timber felled at this time of year (whether the juices putrify or otherwiſe ſweat or dry away) is not only ſubject to rift or gape, but will ſhrink ſo conſiderably, that a piece of ſuch timber of a foot ſquare will uſually ſhrink in the breadth three-quarters of an inch, than which, ſays Vegetius, nothing is more pernicious, if uſed for building of ſhips. To which, Fourthly, the firſt and greateſt Roman Emperor, Julius Cæſar, adds, that though ſhips may be made of ſuch moiſt timber felled in the ſpring, yet they will certainly be ſluggs, not near ſo good ſailors as ſhips made of timber felled later in the year.

In all which circumſtances I find moſt of the ancients ſo very well agree, that none of them adviſe the felling of timber for any ſort of uſe before autumn, at ſooneſt; others not till the trees have borne their fruit, which, ſays Theophraſtus, muſt always be proportionably later, as their fruits are ripe later in the year. A third ſort, not till midwinter; not till November, ſays Palladius; nay, not till the winter ſolſtice, ſays the wiſe Cato, and then too in the decreaſe or wane of the moon; between the fifteenth and twenty-third days of her age, ſays Vegetius; or rather, according to Columella, between the twentieth and the new moon. In general, ſays Theophraſtus, the oak muſt be felled very late in the winter; and not till December, as the Emperor Conſtantinus Pogonatus poſitively aſſerts, the moon too being then under the earth, as it is always in the day-time in the wane or decreaſe. And the felling the oak within theſe limits they call *Tempeſtiva Cæſura*, felling timber in ſeaſon, which they all unanimouſly pronounce (if thus felled) will neither ſhrink, warp, or cleave, nor admit decay in many years, it being as tough as horn, and the whole tree in a manner (as

Theophraſtus aſſerts), as hard and firm as the heart; with whom alſo agrees our countryman, Mr. Evelyn. If you fell not oaks (ſays he) till the ſap is in repoſe, as it is commonly about November and December, after the froſt has well nipt them, the very ſaplings thus cut will continue without decay as long as the heart of the tree.

And the reaſon of all this is given in ſhort by Vitruvius, *quia æris Hyberni vis comprimit et conſolidat Arbores*, becauſe the winter air doth cloſe the pores (the ſap being now retired) and ſo conſequently conſolidates all trees, eſpecially (ſays he) if before the deſcent of the ſap a kerf be cut round the tree, through the ſappy part to the *Medulla* or heart, ſo that the ſap, or ſuperfluous juices, may run forth whilſt the tree is ſtanding and yet living, by which means the oak (as he and Pliny both expreſs it) will acquire a ſort of eternity in its duration. And much more will it ſo, if it be bark't in the ſpring, and left ſtanding naked all the ſummer, expoſed to the ſun and wind, as is uſual in Staffordſhire and the adjacent counties, whereby they find by long experience the trunks of their trees ſo dried and hardened, that the ſappy part in a manner becomes as firm and durable as the heart itſelf.

Which way of barking and felling of timber, though it were unknown to the ancients (as perhaps it is ſtill to all the world beſides theſe few countries), yet they ſeem not unacquainted with the rationality of the practice; for Seneca obſerves the timber moſt expoſed to the cold winds to be the moſt ſtrong and ſolid, and that therefore Chiron made Achilles's ſpear of a mountain tree. Homer alſo tells us, that the ſpear of Agamemnon was ανεμοτρεφες εγχος—made of a tree ſo expoſed, for which Dydimus gives the reaſon: τα γαε ἐν ἀνέμω (ſays he), πλειον νομεναζόμενα δενδρα στερεα:—For that being continually weather-beaten, they became harder and tougher. And Pliny ſays expreſly as much for the ſun as they for the wind, viz. That the wood of trees expoſed to the ſunſhine is the moſt faſt and durable; for which reaſon it is too, that the great Vitruvius prefers the timber on the ſouth ſide of the Appenine, (where it winds about and incloſes Tuſcany and Campania, and ſtrongly reflects the heats of the ſun upon it, as it were from a concave) incomparably beyond that which grows upon the north ſide of the ſame hill, in the ſhady moiſt grounds; of which his opinion he renders us this very good reaſon, For that the ſun does not only lick up the ſuperfluous moiſture of the earth, whence the trees are ſupplied in ſuch ſhady places with too great a quantity, but in great meaſure exhales the remaining juices, after the production of leaves and fruit, out of the trees themſelves, rendering the timber of them the more cloſe, ſubſtantial, and durable, which certainly it would do alſo much more effectually, if the bark were taken off in the ſpring of the year, as is accuſtomed in Staffordſhire, where the people are content to uſe this method in their proviſion of timber, though but for private uſes. Much rather ſhould it be done then in ſo public a concern as the building of ſhips, where tough and ſolid timber is much more neceſſary than in ordinary buildings; nor can I yet meet with any material objections, either from the Staffordſhire Gentlemen, many of whom I have conſulted about this affair, ſince I informed your Majeſty of the advantage of it, or from any others, why this practice may not be uſed here in the ſouth of England as well as there. There is indeed an Act of Parliament, 1 Jac. 1. Chap. 22. whereby your Majeſty's ſubjects are forbid felling timber, in conſideration of the tan, at any other time but between the firſt of April and laſt of June, when the ſap is up, and the bark will run, made on ſuppoſition, I gueſs, that ſhould they have admitted felling of timber in any other ſeaſon, the tanners might have wanted a ſupply of bark. To which I readily anſwer, that I fear the Legiſlators that preſſed the making that Act were ignorant that the bark might be taken off in the ſpring, and that the tree notwithſtanding would live, and flouriſh till the winter following, as I have ſeen many in Staffordſhire; ſo that though the tree be not felled till the winter ſolſtice, or January following, yet the tanner is not at all defeated of his tan, but has it here in as due ſeaſon as in any of the other counties: The Legiſlators, I ſay, were ignorant of this, otherwiſe certainly they would never have made ſuch an Act, ſo pernicious to the whole kingdom, as felling of timber at this ſeaſon is, for the ſake of a few tanners. Beſides, ſecondly, I anſwer, that notwithſtanding this ignorance, yet even then they were ſo wiſe as to except in that Act the timber to be uſed in the building of ſhips, which may be felled in winter, or any other time, as I am told all the ancient timber now remaining in the Royal Sovereign was, it being ſtill ſo hard that it is no eaſy matter to drive a nail into it: So that your Majeſty has no need of giving yourſelf the trouble of procuring the alteration or repeal of that Act, upon this account only, though it may poſſibly be deſirable, becauſe profitable to the ſubject, upon many others.

It is true, indeed, that the barking or pilling the trees ſtanding is ſomewhat more troubleſome, and therefore ſomewhat more chargeable, than when they are proſtrate, and that it is likely people, therefore, have uſually felled their timber, as well for ſhipping as other uſes, in the ſpring of the year, for the ſake of the more eaſy and cheap barking it only, than any thing elſe. It is true too, that timber is harder to fell in winter, it being now ſo compact and firm, that the axe will not make ſo great a riddance as it does in the ſpring, which will alſo increaſe the price of its felling ſome ſmall matter, and ſo of the ſawing afterwards; but how inconſiderable theſe things are, in compariſon of the great good your Majeſty will reap by this manner of felling, as it is plain from what has been ſaid above, I need not acquaint your Majeſty, it being, I think, ſelf-evident. The greateſt objection that I can foreſee will be urged here, in the ſouth, againſt this practice, is, that if the timber be not felled till mid-winter, or January, where it grows in copſes and woods, they cannot perhaps incloſe their young ſprings ſo ſoon as ſome may imagine needful, and therefore will be backward to fell their timber ſo growing at that ſeaſon. To which I anſwer, Firſt, that the timber ſo felled in the woods or copſes may be eaſily carried off before the ſecond ſpring, and the firſt it muſt be there whenever it is felled. But, ſecondly, that which will quite remove this inconſiderable difficulty is, that perhaps your Majeſty may think it expedient that no timber whatever growing in woods or copſes be at all bought into your Majeſty's yards, for that timber growing in ſuch ſhady places, and ſo fenced from ſun and wind as timber in woods for the moſt part is, cannot be ſo good as that which comes from an expoſed ſituation, ſuch as it uſually has in your Majeſty's Foreſts, and in the Chaces, Parks, and Hedge Rows, or upon fields of your ſubjects, where too it is indifferent, at leaſt, if not better, for the proprietor, that it be felled in winter, when the graſs and corn is gone, than in the ſpring itſelf. So that I cannot ſee that your Majeſty has more to do in this matter, in caſe your Majeſty think fit to make uſe of this method, than to order your officers aſſigned for that purpoſe to buy all the timber under ſuch conditions, as to be felled in winter, enjoining the proprietor, unleſs your Majeſty think fit alſo to buy the bark, to take it off in the ſpring in due time, making him ſome ſmall allowance for the greater trouble he will have in pilling it ſtanding. In caſe your Majeſty ſhall pleaſe alſo to make experiment of Vitruvius's advice, of cutting a kerf round each tree, where intended to be felled, through the ſap to the heart, that the ſuperfluous humour may the eaſier run forth; it may likewiſe be conditioned, at the time of the purchaſe, that the workmen may have liberty to come upon the ground alſo, to do that about the beginning of July, when the ſap firſt begins to retire.

Which is all I have met with further at preſent to inform your Majeſty of concerning this matter, wherein if it ſhould ſo happily fall out that I have done your Majeſty any the leaſt ſervice, the internal ſatisfaction I ſhall conceive from it, together with your Majeſty's favourable acceptance, will be an ample reward to

Your Majeſty's moſt loyal, and
moſt obedient ſubject,
ROBERT PLOTT.

N. B. This Copy of Dr. Plott's Diſcourſe is tranſcribed from a MS. Copy in the Navy Office; and the preceding Extract of a Letter from Mr. Pepys, and Sign Manual following, from the original papers in the ſame office.

James R.

WHEREAS We have determined to have an experiment made of a propoſition lately offered by Dr. Plott, of ſtripping and barkeing trees ſtanding in the month of April, when the ſapp aſcends, and cutting them downe in December, for the emproveing the duration of timber; and to that end have given order, by the Lords Commiſſioners of our Treaſury, that one hundred and fifty of our trees in Buſhey Park ſhall be felled in that manner, and employed in the ſervice of our Navy: Our will and pleaſure is, that you forthwith give order for one of the Purveyors of our Navy to attend the ſaid Lords Commiſſioners for his receiving inſtructions to repaire to the ſaid parke, where he is to joyne with ſuch officer belonging to it as he ſhall be directed to by the ſaid Lords, and with his advice to viewe and marke one hundred and fifty trees, ſuch as, according to the beſt of his judgment, may be fitt for the ſervice of our Navy, and yet to be choſen out with the advice of the ſaid officer, ſoe as their being cutt down may leaſt tend to the diſfiguring the ſaid parke; you taking care that in the month of December next the ſaid trees bee accordingly cutt downe, converted for the ſervice of our Navy, and tranſported to ſuch of our yards as you ſhall judge beſt. For which this ſhall be your warrant.

Given at our Court at Whitehall, this 10th of March 1687-8.

By his Majeſty's command,

To the principal Officers and
Commiſſioners of our Navy.

S. PEPYS.

No. 9.

(A.)

Land Revenue Office,
June 6th, 1791.

Gentlemen,

IT appearing by two letters, dated the 28th of October and 14th December 1687, from Samuel Pepys, Eſquire, then Secretary of the Admiralty, to the Commiſſioners of the Navy, and by a Sign Manual of King James the Second, dated 10th March 1687-8, that the King had commanded experiments to be made of the effects of a method recommended by Dr. Plott, in a Diſcourſe on the moſt ſeaſonable time of felling timber, of ſtripping oak trees of their bark in the ſpring, and not felling them until the winter following; we ſend you Extracts of the ſaid Letters, and a Copy of that Sign Manual, and requeſt that you will be pleaſed to inform us, if it appears in your office, whether any and what experiments were made in conſequence of thoſe directions; and what was the reſult of them.

We alſo requeſt you to inform us, Whether the ſhip Royal William, which is underſtood to have been built more than ſeventy years ago, was conſtructed of timber barked and felled in that manner, and in what ſtate her timbers were found when ſhe was reduced from a firſt to a ſecond rate ſhip? What repairs were done to her prior to that alteration, and at what times? and to what cauſe you impute her laſting ſo long?

We are informed that the Navy Board, by an order dated 28th January 1748, directed the officers of Chatham yard to make trial of ſome trees ſerved in by a Mr. Firmin, which had been barked ſtanding, and to report the difference, if any ſhould be found, between them and trees felled in the ordinary way; and we deſire you will be pleaſed to inform us, whether the trial directed by that order was made; upon what ſhip; and whether any and what report was made to your Board of the reſult of that experiment.

Mr. Barnard having mentioned in his examination before the Committee of the Houſe of Commons appointed 1771 to inquire how his Majeſty's navy might be better ſupplied with timber, that he built the Achilles man of war with timber barked in the ſpring, and not felled until the ſucceeding winter, and that upon a trial then lately made it was found that the timber in that ſhip was ſtill very good; we deſire you will be pleaſed to inform us if the caſe is known to you to be as ſtated by Mr. Barnard, and in what year that ſhip was built? What repairs have been given to her? To what amount and at what times? Whether any and what reports were made to your Board of the ſtate of her timbers at ſuch times? Whether ſhe has been much employed in ſervice, and if ſtill in being, or when and how diſpoſed of?

About ſeven years ſince ſome trees were felled in New Foreſt which had ſtood many years without their bark, and were ſuppoſed to have been ſtripped at the deſire of the Navy Board; but as no certain information concerning them can be obtained from the office of the Surveyor General of the Woods, we requeſt you will be pleaſed to inform us, if it appears to you, Whether thoſe trees were ſtripped of their bark by deſire of the Navy Board, and at what time? And whether any experiment was made with them for aſcertaining the difference between timber ſtripped ſtanding, and ſuch as is felled in the ſpring with the bark on? And what was the reſult of ſuch experiment?

And we ſhall be further obliged to you for information of any other trials which may have been made, or any proofs you may have received, of the effects produced on the quality of oak timber by ſtripping off the bark, and letting it ſtand in that ſtate for any length of time before it be felled.

In addition to the information of the ſtate of the tonnage of the Royal Navy at different periods, tranſmitted with your letter of the 12th of laſt month, we requeſt you will have the goodneſs to inform us, if it be known to you, What was the amount of the tonnage of the navy in the reign of Queen Elizabeth, at the time the Spaniſh Armada was on the Engliſh coaſt?

We are,
Gentlemen,
Your moſt obedient
Humble ſervants,

CHA. MIDDLETON.
JOHN CALL,
JOHN FORDYCE.

The Commiſſioners of
His Majeſty's Navy.

(B.)

Navy Office, 13th July 1791.

Gentlemen,

WE have received your letter of the 6th of laſt month, incloſing Extracts of two letters from Mr. Secretary Pepys, with a Copy of a Sign Manual of King James the Second, commanding experiments to be made of Doctor Plott's method of ſtripping oak trees of their bark in the ſpring, and felling them in the winter following; and requeſting to be informed, Whether any and what experiments were made, and what was the reſult thereof? In anſwer thereto we ſend you incloſed a copy of the Navy Board's letters of the 12th December and 17th February 1687, to Mr. Pepys; with a copy of one of the 14th April 1688, from him, on the ſubject of Dr. Plott's diſcourſe relative to the ſtripping and felling timber in order to make it more durable; but it does not appear by the books in this office that there was any correſpondence on the ſubject after that period; and therefore we conclude, that upon the abdication of King James the Second, which took place in December 1688, the matter was dropped, and no experiment whatever made of the timber which was to have been felled for the purpoſe in Buſhy Park.

With reſpect to the Royal William, ſhe was launched in 1719, but whether conſtructed with timber treated in the manner above alluded to, we are not able to trace. She had no repairs prior to 1757, when ſhe was reduced to a ſecond rate, except what was done in her annual trimmings; but as it appears ſhe was five years building, it is not unlikely but that her frame, and the other materials ſhe was built with, were kept ſome time in ſeaſoning, which in ſome meaſure contributed to her duration. Add to this, that ſhe was in harbour in an inactive ſtate from the time ſhe was launched until the year 1757; for if ſhe had been occaſionally in ſervice, it may be concluded that ſhe would have gone to decay, as other ſhips did which were built about the ſame time, the ſeveral parts of which were probably treated, with reſpect to the burning, &c. as the Royal William is ſaid to have been, by the report of the officers of Portſmouth yard in their letter of 23d laſt month, a copy of which is incloſed;

cloſed; a practice, it is believed, at that time in general uſe, and which may have had in ſome degree the effect they attribute to it.

On referring the officers of Chatham yard to the warrant you quote of 28th Jan. 1748, to make trial of ſome trees ſerved in by Mr. Firmin, they inform us they cannot trace that any report was ever made upon the ſubject, nor does it appear by the records in this office that any trial was made in conſequence of the ſaid warrant.

The Achilles, which is repreſented by Mr. Barnard to have been built with timber felled after the bark had been ſtripped, was built in the year 1757, but it is not known to us, as we cannot trace any correſpondence with him on the ſubject, whether that was the caſe or not. She was employed in ſervice from that time until Jan. 1763; in November following was commiſſioned as a guard ſhip, and continued as ſuch till the end of the year 1770.

There was no regular repair given her until 1771, when ſhe was re-fitted for ſea at an expence of 5,192l. (as will appear by the officers report encloſed) and ſent to the Weſt Indies, from whence ſhe returned in March 1773, and was not employed afterwards, being found, on ſurvey, in want of a conſiderable repair. She was ſold in 1784.

With regard to the trees you noticed to have been felled in the New Foreſt after being ſtripped of their bark, we are to obſerve to you, that in the ſpring of the year 1784 two oak trees, and a like number of elm, beech, and aſh, were barked while ſtanding on the manor of Beaulieu on the border of the New Foreſt, by deſire of Mr. Mitchell, then Firſt Aſſiſtant to the Surveyor of the Navy, and the ſaid trees were cut down at the periods mentioned in the report encloſed, furniſhed us by Mr. Adams, a ſhip-builder in the neighbourhood, who aſſiſted in carrying Mr. Mitchell's wiſhes into execution, and the overſeer of the ſhip Mr. Adams was at that time building, but no experiment was made of thoſe trees for aſcertaining their comparative durability.

We cannot find from the books in this office, or from any information we can collect from the officers of the yards, that any trial has been made ſo as to aſcertain which timber has the preference in point of durability, that felled after being ſtripped of the bark, or what is felled in the common way; but an experiment is about to be made on a ſloop intended to be built at Deptford, one half of her with the timber ſtripped in the mode recommended, and the other half with timber felled in the ordinary way, and both cut from the ſame eſtate, from which we hope to be enabled to form ſome well-founded judgment of the matter.

It is not known at this office what was the amount of the tonnage of the Navy in the reign of Queen Elizabeth at the time the Spaniſh Armada was on the Engliſh coaſt.

We are,
Gentlemen,
Your moſt obedient,
Humble ſervants,
HENRY MARTIN,
J. HENSLOW,
GEO. MARSH.

Commiſſioners of the
Land Revenue.

(C.)

Sir,

WE do herewith return you Dr. Plott's Diſcourſe touching the moſt ſeaſonable time of felling of timber for ſhipping, with our thanks for the opportunity you have been pleaſed to give us of peruſing the ſame; for though it has been always our opinion that timber felled in winter, when the ſap is retired, muſt needs be more firm and durable than that which is cut down in the ſpring as the ſap aſcends, yet we are abundantly confirmed in the truth of it by the ingenious reaſoning of the learned doctor in this his Diſcourſe: and if the method ſaid to be uſed in Staffordſhire and other northern counties of this kingdom, of barking the trees in the ſpring and felling them the enſuing winter, after they have ſtood hardening all ſummer, could be introduced and put in practice in the ſouthern parts of the nation, we believe it would be very much for his Majeſty's ſervice: but how to have it done any where but in his Majeſty's own foreſts and parks, when he ſhall pleaſe to have any trees felled there, we humbly leave to conſideration, and remain, &c.

Atteſted, A. D. J. B. J. G. W. H.

Geo. Marſh.

12th Dec. 1687.

Mr. Pepys.

(D.)

EXTRACT of a Letter from the Officers of Portſmouth Yard to the Navy Board, dated 23d of June 1791.

IN obedience to your directions of the 13th inſt. relative to the ſtate of the timbers of his Majeſty's ſhip Royal William when ſhe was cut down here in 1757;

We have carefully examined the records of office, but cannot trace that the timber ſhe was built with had undergone any particular proceſs, but are informed by ſome of the oldeſt workmen that the thick-ſtuff and plank was burnt (inſtead of being kiln'd), alſo that the ends of the beams, the ſaying part of the breaſt hooks, crutches, riders, knees, &c. &c. were gouged in a manner then practiſed, and which was called ſnail creeping, by which means the air was conveyed to the ſeveral parts of the ſhip, which otherwiſe could not have received that advantage, and which we apprehend was very uſeful to her preſervation. We herewith beg leave to incloſe a copy of her ſurvey, as taken a-float in December 1785.

Atteſted,

Geo. Marſh.

(E.)

EXTRACT of a Letter from the Officers of Portſmouth Yard to the Navy Board, dated 11th January 1771.

HAVING, in obedience to your warrant of the 7th of December laſt, taken his Majeſty's ſhip the Achilles into the North Dock to repair the damages ſhe ſuſtained in the late bad weather, pray leave to obſerve, that the timbers of the frame, both within and without, where ſtuff has been taken off, proves exceedingly ſound.

Atteſted,

Geo. Marſh.

(F.)

COPY of a Letter from Meſſrs. Adams and Ancell to the Navy Board; dated Bucklerſhard, 22d June 1791.

Honourable Commiſſioners,

WE pray leave to acquaint you, that on the receipt of yours of 13th inſtant we have examined our memorandums reſpecting the trees on which the experiments were directed to be made by the late Mr. Mitchell, which are as undermentioned, viz.

Two trees of the following ſort had the bark taken off while ſtanding in May 1784—oaks, elms, beech, and aſh.

In the ſpring of the year 1785 none of them ceaſed to vegetate. In the ſpring 1786 the elm and aſh produced leaves on the upper branches, and the beech were in full vegetation; the oaks to appearance were dead, as no leaves were produced at that ſeaſon of the year; that in the fall of the year 1787 one oak and one elm were cut down, as at that time the elm appeared to be dead alſo, the ſap and the ſpine appearing perfectly ſound and hard when converted. In the ſpring 1788 one oak, one elm, and one aſh, were cut down, the aſh being alſo to appearance quite dead, and when converted were found to be exceedingly ſound and tough. In the fall of the year 1788 the beech were alſo cut down, which, notwithſtanding the bark had been off upwards of four years, were in full vegetation, but were both very doated. In the latter end of the ſame year, by deſire of the late Mr. Mitchell, Mr. Ancell ſent a piece of each tree in a box directed to him at the Navy Office; and that ſome time afterwards he received a letter from Mr. Mitchell, in which he informed him that he had received the ſaid box, and did not expect to find the oak ſo near the weight of green oak. The remaining aſh was cut down in the fall of the year 1790, and was found perfectly ſound and tough.

Atteſted, We are,
Geo. Marſh. Honourable Sirs,
Your moſt obedient ſervants,
HENRY ADAMS,
J. ANCELL.

No. 10.

Gentlemen, Redbridge, 2d May 1791.

IN anſwer to Mr. Harriſon's letter of the 29th paſt, I beg to acquaint you, that as ſtripping trees of their bark ſtanding has not been a practice in the country, I have not been able to aſcertain exactly what the difference of the expence will be between that and the uſual way of ſtripping. For the trees which have been ſtripped ſtanding in the foreſt, the difference which the Deputy Surveyor paid was four ſhillings a load; that is, for a coppice load, which contains 60 yards in length, as ſet to the poles, which for ſtripping in the uſual way for that kind of bark the price is nine ſhillings; but I think it was an impoſition; the difference, in my opinion, ought to have been no more than two ſhillings.

By ſtripping trees ſtanding, I do not conceive that there would be much loſs of the bark, or any injury done to their tops; as I think the tops ſhould be cut off the trees at the ſtripping time, and ſtripped on the ground, or ſuch parts of them that were not conſidered as timber, and to go with the bodies of the trees: for by this the trunks of the trees would be got at with more eaſe, and the bark ſtripped with greater facility, though it would certainly be attended with more trouble than the uſual way of doing it, and conſequently would be more expenſive; but I judge that two ſhillings a load, in addition to the uſual price (I mean a coppice load), would be a ſufficient compenſation, and leſs, if the practice ſhould become general, as the people would be better acquainted with it.

The trees that were ſtripped of their bark ſtanding in the foreſt in the ſpring of 1789, came out in leaf and vegetated nearly as vigorous that ſpring as the other trees; but laſt ſpring their vegetation was weak, and moſt of them appeared in a dying ſtate; and I judge that the whole of them will be quite dead this ſummer, and think that they ſhould be felled in the autumn of 1792; and ſo on for others at the ſame diſtance of time from their being ſtripped.

The old trees, which I ſuppoſed to have been ſtripped of their bark ſtanding, in Aſhurſt Walk, and which I had felled ſeven years ago, I remember them to have been perfectly ſound; but not having at that time any ideas for what purpoſe they might have been ſtripped, I did not take particular notice of them. In a converſation I had ſome time afterwards with the late Mr. Mitchell, he informed, that he had found, by a minute of the late Mr. Bately's, that he had ſome trees ſtripped of their bark ſtanding in the New Foreſt and in Aſhurſt Walk. I judge that this muſt have been when Mr. Bately was one of the builders aſſiſtants of Portſmouth yard, which was between fifty and ſixty years ago, and therefore imagine that theſe were ſome of the trees that he had ſtripped at that time.

I am,
Gentlemen,
With much reſpect,
Your moſt humble ſervant,
THOMAS NICHOLS.

Com. of the Land Revenue.

No. 11.

Gentlemen, Navy Office, 23d January 1792.

WE have received your letter of the 12th inſtant, deſiring to know the terms on which the ſhipwrights of the ſeveral yards, towards the cloſe of the laſt war, offered to diſcontinue the practice of carrying out chips upon a reaſonable compenſation being made them; and likewiſe our propoſition to the Right Honourable the Lords Commiſſioners of the Admiralty in conſequence thereof. We herewith ſend you copies of the correſpondence with their Lordſhips, and Commiſſioners and Officers of the ſeveral yards on the ſubject: alſo a copy of our letter to their Lordſhips, of the 25th October 1783, recommending our entering into an agreement with the men thereon; to which we have received no anſwer.

We are,
Gentlemen,
Your moſt obedient humble ſervants,
HENRY MARTIN,
JOHN HENSLOW,
GEO. MARSH.

Com. Land Revenue.

Sir, Navy Office, 1ſt October 1783.

WE deſire you will pleaſe to inform the Right Honourable the Lords Commiſſioners of the Admiralty, that having taken into conſideration the many enormous abuſes committed under the indulgence of chips, and wiſhing to apply every remedy in our power to ſo growing and waſteful an evil, we have embraced the firſt opportunity, ſince the return of peace, to renew and enforce the old ſtanding rules of the Navy concerning them; but though the execution of theſe orders has been preſſed from time to time, yet on attempting the preſent reformation, we found that the abuſe had reached ſuch a dangerous height, as required firmneſs and reſolution to encounter it.

Our attempt, however, has produced an offer from Plymouth yard to give up the privilege of chips for 5d. per day to the ſhipwrights; a ſum that, with the preſent pay, will be 1s. 6d. leſs than houſe carpenters receive in London, and 2s. 6d. per day leſs than is given in merchants yards.

The cuſtom hitherto has been for the men to leave off work perhaps half an hour before bell-ringing, and even during working hours, to cut up clandeſtinely uſeful timber to complete their bundles, which are frequently ſold as high as 1s. each, and probably coſt the public twice as much; and though there be nothing ſo frequent in our Minutes as orders reſpecting chips, yet the abuſe has ſtill returned, and public affairs at times ſo critically circumſtanced as to put it out of the officers power to take proper notice of it. From theſe conſiderations, and the impoſſibility of keeping this evil under proper reſtraint, we ſubmit to their Lordſhips the propriety of empowering us to treat immediately with the ſhipwrights of Plymouth yard, as an example to the other yards, who, we doubt not, will accept the propoſal, if we can once eſtabliſh it at any particular place.

We would propoſe 4d. inſtead of 5d. to the ſhipwrights, 2d. to the houſe carpenters, and 2d. to the preſent ſervants, till they have finiſhed the terms of their apprenticeſhips. This additional wages to be entered an extra ſum on the pay-books as in lieu of chips, that the perquiſites may never on any pretence come in future uſe. That there ſhould be no alteration in the other extra pay; and that no ſervants, after the preſent ſet, ſhould be entitled to chips, or any allowance in lieu of them.

By ſeizing the preſent opportunity, which we moſt earneſtly recommend to their Lordſhips, the public will have the full advantage of the common working hours; incredible quantities of uſeful timber will be preſerved from waſte; opportunities of ſecreting valuable ſtores, ſuch as copper, braſs, &c. will be taken away; and the diſcipline of the yards in a great meaſure reſtored. In ſhort, by cloſing in with the preſent propoſal, an evil for which no effectual remedy could ever be found, yet of ſuch a pernicious growing nature as to threaten the worſt conſequences to the ſervice, will be at once ſubdued, and the public gain in time and ſave in timber and other ſtores infinitely beyond the additional expence. Indeed the expence can hardly be reckoned more than an equivalent for the working time that is now loſt in making up the bundles.

Atteſted,
Geo. Marſh.
Philip Stephens, Eſq.

We are,
Sir, &c.

Sir,

Navy Office, 25th October 1783.

HAVING, ſince our letter of the firſt inſtant, informing the Right Honourable the Lords Commiſſioners of the Admiralty of an application from the ſhipwrights of Plymouth yard for an allowance of wages in lieu of chips, received a like application from thoſe at Chatham and Portſmouth, we ſend you the ſame herewith; and as we have no doubt, from the ſhipwrights of theſe three principal yards having made this application, that the others would readily come into it, we beg leave earneſtly to recommend to their Lordſhips the entering into agreement with all the yards, for the reaſons aſſigned in our before-mentioned letter, as we have no doubt but the expence incurred in the ordinary of the navy will be trebly repaid on the extra.

Atteſted,
Geo. Marſh.
Philip Stephens, Eſq.

We are, &c.

No. 12.

COPY of a Letter from Thomas Mitchell, Eſq. late Firſt Aſſiſtant to the Surveyor of the Navy, to John Fordyce, Eſq. one of the Commiſſioners of the Land Revenue.

Sir,

Navy Office, 28th February 1789.

A CORRESPONDENCE for ſome time having been kept up between the late Lam. Yeams, Eſq. her Imperial Majeſty's principal builder at St. Peterſburgh, and myſelf, through the means of the late Admiral Sir Charles Knowles, I requeſted he would ſend me the ſtate of ſhip-building in that country, the materials made uſe of for that purpoſe, and what proficiency had been made in the art. Mr. Yeams appeared to be a ſenſible, experienced gentleman, having at that time been more than 46 years maſter ſhipwright in that country, and, as he then informed me, was more than 76 years of age. As his account relates much to your 15th and 16th Queries, I ſhall give it in his own words.

"St. Peterſburg, 16th Auguſt 1783.

"The Crown ſhips at this place are built of oak tranſported from Cazan, and other diſtant places, by the communication of ſeveral rivers. 'Tis uſually on its way hither two years; and although brought down in veſſels, yet by accidents frequently becomes ſo water-ſoaken as ſcarce ever to dry again. The nature of it is much the ſame as the American, of an open ſpungy grain, and of courſe not very durable.

"Subſtantial knees, or compaſs ſtuff, are not over plenty; to ſupply the place of the former we uſe the roots of white pine, which are as durable as the oak; and for the latter, our circular timbers are formed from large logs, to be ſure much grain-cut. Long plank is not wanted from thirty to forty-five feet and upwards; but for want of mills or good ſawyers, it comes down ſo badly hewed, that every piece muſt be trimmed on both ſides to render it fit for the purpoſe wanted.

"In Archangel the Crown's ſhips are built of larch, a wood rather preferable to oak in point of duration, but in reſpect to moulding ſtuff the ſame as the oak. Store ſhips and merchant ſhips are all built of fir, moſtly after the Hollanders' faſhion. Workmanſhip in general is but coarſely performed in this country. To ſerve a regular apprenticeſhip is not known; and every one who can uſe his hatchet is looked on as a carpenter. The hatchet and adze are the only tools they are any wiſe dextrous with. Augers, planes, mallets, chiſſels, and hand-ſaws, are very badly handled by them; ſo you may judge how our workmanſhip is in general performed.

"As there are a fixed number of workmen kept up, in caſe of mortality the number is completed from recruits that are yearly taken from the army, &c. &c. who, by a little practice, become as uſeful as the reſt. Notwithſtanding all this, there are to be found, here and there, ſome ingenious men. Freedom and vaſſalage have their different effects; the latter too often ſuppreſſes the moſt ſhining qualifications.

"In former days, when the Emperor Peter the Firſt lived, our profeſſion was in great eſteem. Himſelf was a maſter builder; and, in ſhort, even ſo of every profeſſion concerning the marine. He fixed the ſalaries of all in the navy, very ſufficient at that time for a plentiful maintenance; but as commerce and population are ſince immenſely increaſed, the ſituation of the lower and middle ſorts wears not the face as it did formerly, when men of fortune were brought up in the line of builders, and the profeſſion in univerſal eſteem. Every thing, even in my time, bore a very reaſonable price; but of late years it has ſprung up to double the price, or more.

"The quantities of iron that come down to this place are very great; the Government has its mines, as well as great numbers of private merchants and gentlemen; but the Admiralty do not confine themſelves to uſe any particular ſorts, either the produce of the Crown's mines or thoſe of private perſons, but purchaſe it promiſcuouſly in ſuch quantities as the occaſion requires it, ſtanding out the uſual proof."

Thus far Mr. Yeams on this ſubject.

John Fordyce, Eſq. THOMAS MITCHELL.

No. 13.

QUESTIONS propoſed to JOHN STRANGE, *Eſq. late Britiſh Miniſter at Venice, at the Deſire of Sir* CHARLES MIDDLETON, *Bart. Comptroller of the Navy, with his Anſwers.*

QUESTION 1.

The manner in which the ſhips are preſerved from the weather?

ANSWER.

The Venetian ſhips of war are built, and preſerved from the weather while building, under ſheds covered with tiles, reſembling the roofs of houſes, ſupported moſtly by brick walls on each ſide, to defend the workmen in winter from the inclemency of the weather; which walls are as high as the upper parts of the ſhips reach, and ſecured by croſs beams high enough to admit of the ſhips being launched under them. The ſheds cover the ſhips completely on both ſides, but are open at the ſtem and ſtern, only projecting a few feet farther out, and there they have temporary covers of boards to keep out the rain. There are alſo in the arſenal of Venice ſome ſheds of a ſimilar conſtruction over a kind of baſons or canals, under which ſhips lie afloat, and where four or five old rotten ſmall frigates and ſloops are actually ſheltered at preſent, their maſts having been taken out. There are about thirty of thoſe ſheds along both the ſides and at the upper end of a canal, all contiguous to and communicating with each other, beſides a great number for keeping ſtores and various other uſes.

QUESTION 2.

The ſize of the ſhips as to tonnage and number of guns?

ANSWER.

There are juſt now eighteen large ſhips on the ſtocks in the arſenal of Venice, and four ſomewhat ſmaller. The largeſt carry eighty guns, but have only fourteen guns on a ſide on the two decks, and the reſt are on the quarter deck and forecaſtle, ſmall guns ſix and four pounders. The largeſt on the lower deck have a diameter of 6¼ inches Engliſh, and carry balls of about 32lb. weight, which they call 50; the guns on the other deck are about ſix inches diameter. The other ſhips, which they call frigates, carry from ſixty to ſeventy guns, thirteen on a ſide on the two decks, and the reſt ſmall guns above; the caliber is about 24 pounders. They uſe braſs guns on their men of war, and have a good number in the arſenal, the greateſt part in good condition; they weigh from 4,500lb. to 6,000lb. but their iron guns are very clumſy and bad, few of them appearing fit for uſe. Fourteen of their largeſt ſhips have only 126 Venetian feet length of keel, and 38 Venetian feet extreme breadth, 18 feet hold, and about 6 feet between each deck. The gun ports appear crouded, and the ſpace for managing them too ſmall. The others, that have been laid down a few years ago, are 140 Venetian feet keel, and the ſcantling of their timbers is a good deal larger, though ſtill not large enough, nor placed cloſe enough for fighting ſhips. They have no ſmall frigates of any kind built or a-building; and, excepting the above-mentioned, their navy at preſent conſiſts only of four of their largeſt ſhips at Corfu, and one in the arſenal under repair; four of their frigates of 60 to 70 guns, four iciambers, and twelve gallies.

QUESTION 3.

Whether they are continued at the places they were built at?

ANSWER.

The ſhips remain under the ſheds till launched.

QUESTION 4.

If entirely finiſhed, or in what degree?

ANSWER.

They are quite finiſhed on the outſide before launching, but the joiners work, &c. is generally done after they are in the water.

QUESTION 5.

How long the oldeſt of them may have remained in their preſent ſtate?

ANSWER.

The oldeſt of them, near three fourths of the whole, have lain about fifty-nine years under the ſheds; ſome of thoſe are ſtill only bare frames, with no more than the neceſſary planks to keep them together; others are partly or altogether caulked.

QUESTION 6.

If ſubject to decay; and in what degree, compared with ſhips a-float?

ANSWER.

Thoſe ſhips that have remained ſo long on the ſtocks under the ſheds, do not ſhew any outward marks of decay, only their timbers are evidently ſhrunk very much; and it is natural to think that, the whole moiſture and ſap being ſo thoroughly dried up and withered, the wood muſt become brittle, and would be apt to fly into ſplinters in an action. I have alſo been told by ſome of the moſt intelligent Venetian ſhipwrights, that great prejudice is derived from the cuſtom that prevails here of throwing the timber, freſh cut, into ſalt water, and letting it lie there till wanted; afterwards it is dried and withered on the outſide under the ſheds, while the inſide, being ſoaked with ſalt water, rots before it becomes dry; and this may be one reaſon, among ſeveral others, why the Venetian men of war, though built of good timber, laſt ſo ſhort a time; for the ſalt moiſture not only rots the inſide of the beams and timbers, but of courſe ruſts and corrodes the iron bolts, of which they uſe a very great number. Beſides, the ſcantlings of their timbers ſeem by far too ſmall, and the diſtance between them too great; the ſide of an Engliſh frigate of twenty guns, I am confident, is ſtronger in every reſpect than of a Venetian ſhip of eighty. The weight of their guns alone would be ſufficient to tear them to pieces in the heavy ſeas in the ocean. It requires the obſervation and experience of thoſe of the profeſſion to determine whether ſhips are more liable to decay in the water and expoſed to the open air, than under cover. Sheds are certainly preferable in building, or giving a thorough repair to ſhips; as, in the firſt caſe, the timber is preſerved from the inclemency of the weather, and ſeaſoned at the ſame time; and, in the laſt, the work is not liable to interruption. But it does not appear ſo clear that laying up men of war under ſheds is attended with equal advantage or convenience: the maſts muſt be taken out, and the air never can circulate freely under ſuch covers, however well contrived.

QUESTION 7.

If any parts are left open for air, and what?

ANSWER.

There ſeems to be no ſettled rule here in this particular, though, doubtleſs, it is of importance; in ſome of the ſhips a plank is left out here and there in the bottom, and others have been fully caulked theſe many years; and two or three have even the port holes and hatches ſhut.

QUESTION 8.

How guarded againſt accidents?

ANSWER.

During the night there is a guard of about a hundred men, compoſed of thoſe who are in the ſervice of the arſenal. In the day there are people who attend at the gate and take down the names of ſtrangers; and none but thoſe belonging to the arſenal are permitted to walk in it without ſome perſon attending them.

QUESTION 9.

If not ſubject to decay, whether the frame is not thought better for ſtanding?

ANSWER.

As before obſerved, the frame is no doubt better for ſtanding a few years under the ſheds till the wood is thoroughly ſeaſoned; but not till it becomes quite ſapleſs and withered.

QUESTION 10.

If the bottom and ſides are caulked or left uncaulked till ordered to be launched?

ANSWER.

Some of the ſhips have remained near ſixty years with their ribs quite bare, like ſkeletons, and ſome others have been caulked almoſt as long: in both caſes they have probably ſuffered detriment, and could not be depended on without a thorough examination, which, however, is much more eaſily performed in thoſe that are uncaulked. The ſeams of thoſe that have been ſo long caulked are very wide, and nothing hinders the oakum from falling out but the pitch, wherewith they are well ſmeared: their way here is to drive in the old oakum, and before launching give a freſh caulking; and though the planks are in ſeveral places ſo much ſhrunk that they ſeem to require new pieces, yet the workmen ſay the whole is filled up with oakum. If this method is practiſed without exception, their new ſhips are little better than their old.

QUESTION 11.

How ſoon can they be put into the water, from the ſtate they are in, if wanted for ſervice?

ANSWER.

Five or ſix of the ſhips in the greateſt forwardneſs might be put into the water in a month's time, ſuppoſing the ſuperficial method indicated in the laſt article were adopted; but if the work was done as it ought to be, I fear it would require ſix months; though none but a profeſſional judge can determine this Queſtion, and theſe, I apprehend, are very different in England from what they are at Venice.

QUESTION 12.

Whether painted, or not, before launching?

ANSWER.

They are never painted before launching; but the bottom is well ſheathed with larch, which makes an excellent ſtrong ſheathing, and covers, at leaſt, all defects as far as it reaches.

Land Revenue Office,
Scotland Yard,
6th February 1792.

CHA. MIDDLETON,
JN. CALL,
JOHN FORDYCE.

TWO ESSAYS

RELATING TO

SHIPPING.

I. On the First Invention of Shipping.
II. On the Royal Navy and Sea Service.

By Sir WALTER RALEIGH, Knt.

[PUBLISHED IN 1650.]

I.

EXTRACTS OF A DISCOURSE OF THE INVENTION OF Ships, Anchors, Compaſs, &c.

——— I DOE not thinke that any one nation (the Syrian excepted) to whom the knowledge of the arke came, as the ſtory of the creation did, ſoone after Moſes, did find out at once the device either of ſhip or boate in which they durſt venture themſelves upon the ſeas; but being forced by neceſſity to paſſe over rivers or lakes, they firſt bound together certaine reeds or canes, by which they tranſported themſelves: *Calamorum falces* (ſaith D. Siculus) *admodum ingentes inter ſe conjungunt*.

Others made raffes of wood, and other deviſed the boate of one tree called the Canoe, which the Gaules upon the river of Roan uſed in aſſiſting the tranſportation of Hannibal's army in his enterpriſe of Italie: *Primùm Galli inchoantes cavabant Arbores* (ſaith Livie [*]); but Polydore Virgill [†] gives the invention of thoſe canoes to the Germans inhabiting about the river of Danubius, which kind of hollow trees Iſidor calls carabes.

The Britons had boats made of willow twigs and covered on the outſide with bullock hydes, and ſo had the Venetians; of which *Lucan*, *Primum cana ſalix*, &c. *Malefacto*, &c. and *Julius Solinus*, *Navigant autem Vimineis alveis quos circundant ambitione tergorum Bubalorum*. The ſame kind of boats had the Germans (ſaith Iſidor [‡]), who in his time committed many robberies in them: but whoſoever deviſed the canoe among the Danubians, or among the Gaules, ſure I am that the Indians of America never had any trade with either of theſe nations; and yet from Frobiſher's Straits to the Straits of Magellane thoſe boats are found, and in ſome parts of that length, as I have ſeene them rowed with twenty oars of a ſide.

The truth is, that all nations, how remote ſoever, being all reaſonable creatures, and enjoying one and the ſame imagination and fan-

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[*] Livie 1. Lib. Dec.

[†] Polidor. Lib. 3.

[‡] Iſidor. Orig. 9. de Navig. Cap. 1.

taſie,

taſte, have deviſed according to their means and materialls the ſame things.

The Eaſtern people, who have had from all antiquitie the uſe of iron, have found out the ſawe; and with the ſawe they have ſundered trees in boards and planks, and have joyned them together with nayles, and ſo made boats and gallies ſafe and portable; ſo have they built cities and townes of timber, and the like in all elſe.

On the contrary, the Weſt Indies and many nations of the Africans, wanting means and materialls, have been taught by their own neceſſities to paſſe rivers in a boate of one tree, and to tye unſquared poles together on the top for their houſes, which they cover with large leaves. Yea the ſame boats, and the ſame buildings, are found in countries two thouſand miles diſtant, debarred from all commerce by unpaſſable mountains, lakes, and deſerts. Nature hath taught them all to chooſe kings and captains for their leaders, and judges. They all have lighted on the invention of bowes and arrowes; all have targets and woodden ſwords; all have inſtruments to encourage them to fight: all that have corne beate it in mortars and make cakes, baking them upon ſlate-ſtones: all deviſed lawes without any grounds had from the ſcriptures, or from Ariſtotle's Politiques, whereby they are governed: all that dwell neere enemies impale their villages to ſave themſelves from ſurprize. Yea, beſides the ſame inventions, all have the ſame naturall impulſions; they follow nature in the choice of many wives, and there are every where among them, which, out of a kind of wolviſh ferocitie, eate man's fleſh; yea, moſt of them believe in a ſecond life, and they are all of them idolaters in one kind or other.

For the Northerne parts of the world, it was long ere they grew to any perfection in ſhipping; for wee read that Hengiſt and Horſa came over into this land in long boats, in which for the firſt being called in by Britons, they tranſported five thouſand ſoldiers. And that after they came with a ſupply of ten thouſand more ſhipt in thirty veſſels, which the Saxons call *Keeles*, and our old hiſtorians *Cogiones*. And in Cæſar's time, the French Britons who were then eſteemed the beſt Britaine ſeamen, had very untoward tubs, in which they made warre againſt him; for they tooke the winds in ſailes of leather, heavy and unpliable, and they faſtened their ſhips to the ground, and rid at anchor with cables of iron chains, having neither canvas nor cordage; inſomuch as the beſt of them which were of Vannes are deſcribed with high heads raiſed up deformedly above the reſt of the buildings: to which kind of forme that they were conſtrained, the reaſon is manifeſt; for had their cables of iron chains held any great length, they had been unportable; and being ſhort, the ſhips muſt have ſunck at an anchor in any ſtreame of weather or countertyde. And ſuch was their ſimplicitie in thoſe days, as inſtead of accommodating their furniture to their ſhips, they formed their ſhips to their furniture; not unlike the courtiers of this age, who fit their bodies and their feet to their doublets and ſhooes, and not their doublets and ſhooes to their bodies and feete.

The Pomerlanders inhabiting the South part of the Baltic, or Eaſtland Sea, uſed a kind of boate with a prowe at both ends, ſo as they need not to wend or hold water, but went on and returned indifferently, of which Tacitus *: *Suionum hinc Civitates ipſo in oceano præter viros armaque claſſibus valent; forma navium eo differt, quod utrinque prora paratam ſemper appulſui frontem agit: nec velis miniſtrantur; nec remos in ordinem lateribus adjungant. Solutum ut in quibuſdam fluminum & mutabile ut res poſſit hinc vel illinc remigium.*—" Next are the cities of the Suionum, which are mighty at ſea, not only in men and armes but in fleete. The forme of their veſſells differ in this, that a prowe at each end enables them to row forward either way alike: neither uſe they ſayles, nor place their oars in order upon the ſides, but carrying the oare looſe, they ſhift it hither and thither at pleaſure, as is the manner in ſome rivers."—Yea at this time both the Turkes and Chriſtians uſe theſe kind of boats upon the river of Danubius, and call them *Nacerne*.

True it is, that before Cæſar's invading of this land we doe find that the Britons had not any ſhipping at all, other than their boats of twigs covered with hydes as aforeſaid.

The Saxons, when they were drawne in by the Britons, came hither by ſea. And after that time, finding that without ſhipping they could neither defend themſelves nor exerciſe any trade, they began to make ſome proviſion for a navy, ſuch as it was; which being firſt conſidered of by Egbert, Alfred, Edgar, and Etheldred, augmented it. And how true it is I know not, but it is written of Edgar, that he increaſed the fleete he found two thouſand ſix hundred ſaile. After whom Etheldred made a law, that whoſoever was lord of three hundred and ten hide land, ſhould build and furniſh one ſhip for the defence of their country.

Notwithſtanding all theſe proviſions the Danes invaded them, and having better ſhips than they had, made their way for a new conqueſt.

The Normans grew better ſhipwrights than either of both, and made the laſt conqueſt of this land; a land which can never be conquered whilſt the kings thereof keep the dominion of the ſeas, which dominion I doe not find that it was ever abſolute till the time of Henry the Eight, but that we fought ſometime with good, ſometime with ill ſucceſſe.

But, omitting the diſpute of the firſt navigators, certaine it is, that the invention of the Compaſſe was had from our northerne nations, were it from the Germans, Norvegians, Britons, or Danes; for even to this day the old northerne words are uſed for the diviſion of winds upon the quarter of the Compaſſe, not only by the Danes, Germans, Swedes, Britons, and all in the ocean that underſtand the termes and names of the winds in their owne language; but the French and Spaniſh called the ſun-riſing winds Eaſt or Eaſt, and the ſunne-ſetting winds Weſt, the reſt North and South, and ſo by the ſame termes, in all the diviſions of Southeaſt, Northeaſt, Southweſt, Northweſt, and the reſt.

And if we compare the marveilous great tranſportations of people by the Saxons, Angles, Danes, Gothes, Swedes, Norwegians, eſpecially, and other, and how many fleets for ſupplies have been ſet out by them, with the ſwarmes of Danes aſwell in our ſeas as when they invaded and conquered Sicilie, together with the colonies planted by the Tyrians in Africa, as elſewhere, and of the Carthaginians, the ſons of the Tyrians in Spaine; it is hard to judge which of theſe nations have moſt commanded the ſeas, though for priority Tibullus and Ovid give it the Tyrians. *Prima ratam Ventis credere docta Tyros*[*]: and Ovid, *Magna minorque fere quarum regis altera gratias*; *altera Sydonias uterque ſicca rates.*

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* Tacitus De Moribus German.

And it is true that the firſt good ſhips were among the Tyrians, and they good and great ſhips, not long after the warre of Troy; and in Solomon's time they were of that account, as Solomon invited Hiram King of Tyre to joyne with him in his journey into the Eaſt Indies; for the Iſraelites till then never traded by ſea, and ſeldome, if ever, after it; and that the Tyrians were the chiefe in that enterpriſe, appears in that they were called *nautas peritos maris*; in the Hebrew (ſaith Junius[†]) *homines navium*; and in our Engliſh, *marriners*.

It is alſo written in the ſecond of Chronicles the eight, that Hiram ſent Solomon ſhips, *et ſervos peritos maris*, “ and ſervants ſkilfull of the ſea;” whereby it is probable that the Tyrians had uſed the trade of Eaſt India before the dayes of Solomon, or before the raigne of David, when themſelves commanded the ports of the Red Sea. But the Edumæans being beaten by David, and the port of Ezion-Geber now ſubject to Solomon, the Tyrians were forced to make Solomon the chiefe of that expedition, and to joine with him in the enterpriſe; for the Tyrian had no paſſe to the Red Sea but through the territory of Solomon, and by his ſufferance.

Whoſoever were the inventers, we find that every age had added ſomewhat to ſhips, and to all things elſe. And in my owne time the ſhape of our Engliſh ſhips hath been greatly bettered. It is not long ſince the ſtriking of the Top-maſt (a wonderfull great eaſe to great ſhips both at ſea and harbour) hath been deviſed. Together with the Chaine-pumpe, which takes up twice as much water as the ordinary did, we have lately added the Bonnett, and the Drabler. To the courſes we have deviſed Studding Sayles, Top-gallant Sayles, Sprit Sayles, Top Sayles. The weighing of Anchors by the Capſtane is alſo new. We have fallen into conſideration of the length of Cables, and by it we reſiſt the malice of the greateſt winds that can blow; witneſſe our ſmall Milbrooke men of Cornewall, that ride it out at anchor half ſeas over betweene England and Ireland all the winter quarter; and witneſſe the Hollanders that were wont to ride before Dunkirke with the wind at Northweſt, making a lee ſhore in all weathers: for true it is that the length of the Cable is the life of the ſhip in all extremities; and the reaſon is, becauſe it makes ſo many bendings and waves as the ſhip riding at that length is not able to ſtretch it, and nothing breaks that is not ſtretched. In extremity, we carry our Ordnance better than we were wont, becauſe our Netheroverloops are raiſed commonly from the water, to wit, betweene the lower part of the port and the ſea.

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[*] Tibull. Eleg. Strab. Lib. 16.

[†] Junius I. Kings, Cap. 9.

In King Henry the Eight's time, and in this preſent, at Portſmouth the Marie Roſe, by a little ſway of the ſhip in caſting about, her ports being within ſixteene inches of the waters, was overſet and loſt, and in her that worthy Knight Sir George Carew, cozen-germaine to the Lord Carew, and with him (beſides many other gentlemen) the father of the late renowned Sir Richard Greenevile.

We have alſo raiſed our ſecond decks and given more vent thereby to our ordnance, tying on our netheroverloope.

We have added croſſe pillars in our royall ſhips to ſtrengthen them, which be faſtened from the kelſon to the beams of the ſecond decke, keepe them from ſetling or from giving way in all diſtreſſes.

We have given longer floares to our ſhips than in elder times, and better bearing under water, whereby they never fall into the ſea after the head, and ſhake the whole body, nor ſinck ſterne, nor ſtoope upon a wind, by which the breaking looſe of our ordnance, or the not uſe of them, with many other diſcommodities, are avoided.

And to ſay the truth, a miſerable ſhame and diſhonour it were for our ſhipwrights, if they did not exceed all other in the ſetting-up of our royall ſhips, the errors of other nations being farre more excuſable than ours. For the Kings of England have for many years been at the charge to build and furniſh a Navy of powerfull ſhips for their owne defence, and for the wars only: whereas the French, the Spaniards, the Portugalls, and the Hollanders (till of late) have had no proper fleete belonging to their princes or ſtates.

Only the Venetians for a long time have maintained their arſenal of Gailyes, and the Kings of Denmark and Sweden have had good ſhips for theſe laſt fifty years. I ſay, that the forenamed Kings, eſpecially the Spaniards and Portugalls, have ſhips of great bulke, but fitter for the merchant than for the man of warre, for burthen than for battaile. But, as Popelinire well obſerveth, the forces of Princes by ſea are *marques de grandeux d'eſtate*, "are markes of the greatneſſe of an eſtate:" for whoſoever commands the ſea commands the trade: whoſoever commands the trade of the world commands the riches of the world, and conſequently the world itſelf.

——————— I myſelf may remember when one ſhip of her Majeſties would have made forty Hollanders ſtrike ſayle, and to come to anchor. They did not then diſpute *de mari libero*, but readily acknowledg'd the Engliſh to be *Domini maris Brittanici:* that we are leſſe powerfull than we were I doe hardly believe it; for although we have not at this time 135 ſhips belonging to the ſubjects of 500 tuns each ſhip, as it is ſaid we had in the 24th yeare of Queen Elizabeth, at which time alſo, upon a generall view and muſter there were found in England of all men fit to beare armes, eleaven hundred and ſeventy-two thouſand; yet are our merchants ſhips now farre more warlike and better appointed than they were, and the Navy Royall double as ſtrong as then it was; for theſe were the ſhips of her Majeſties Navy at that time.

1. The Triumph,
2. The Eliz. Jonas,
3. The White Beare,
4. The Phill. and Mary,
5. The Bonaventure,
6. The Golden Lion,
7. The Victory,
8. The Revenge,
9. The Hope,
10. The Mary Roſe,
11. The Dreadnought,
12. The Minion,
13. The Swiftſure.

To which there hath been added,

14. The Antelope,
15. The Foreſight,
16. The Swallow,
17. The Handmaide,
18. The Gennett,
19. The Barque of Bullen,
20. The Ayde,
21. The Achates,
22. The Falcon,
23. The Tyger,
24. The Bull.

We have not therefore leſſe force than we had, the faſhion and furniſhing of our ſhips conſidered; for there are in England at this time 400 ſaile of merchants fit for the wars, which the Spaniards would call Gallions; to which we may add 200 ſaile of Crumſters, or Hoyes of Newcaſtle, which each of them will bear ſix demiculverins, and foure ſakers, needing no other addition of building than a ſlight ſpar decke fore and afte, as the ſeamen call it, which is a ſlight decke throughout. The 200 which may be choſen out of 400, by reaſon of their ready ſtaying and turning, by reaſon of their windwardneſſe, and by reaſon of their drawing of little water, and they are of extreame vantage neere the ſhoare, and in all bayes and rivers to turne in and out; theſe, I ſay, alone, well manned, and well conducted, would trouble the greateſt Prince of Europe to encounter in our ſeas; for they ſtay and turn ſo readily, as, ordering them into ſmall ſquadrons, three of them at once may give their broad-ſides upon any one great ſhip, or upon any angle or ſide of an enemies fleet. They ſhall be able to continue a perpetuall volley of demiculverins without intermiſſion, and either ſink or ſlaughter the men, or utterly diſorder any fleete of croſſe ſailes with which they encounter.

I ſay then, if a Vanguard be ordeined of theſe Hoyes, who will eaſily recover the wind of any other ſhips, with a battaile of 400 other warlike ſhips, and a reare of thirty of his Majeſties ſhips to ſuſtaine, relieve, and countenance the reſt (if God beat them not), I know not what ſtrength can be gathered in all Europe to beat them. And if it be objected that the States can furniſh a farre greater number, I anſwer, that his Majeſties 40 ſhips, added to 600 before-named, are of incomparable greater force than all that Holland and Zeeland can furniſh for the wars; as alſo that a greater number would breed the ſame confuſion that was found in Xerxes land army of ſeaventeene hundred thouſand ſouldiers: for there is a certaine proportion, both by ſea and land, beyond which the exceſſe brings nothing but diſorders and amazement.

Of thoſe Hoyes, Carvills, or Crumſters, call them what you will, there was a notable experience made in the yeare 1574, in the river of Antwerpe, neere Rummerſwael, where the Admirall Boyſett with his

Crumſters overthrew the Spaniſh fleet of great ſhips conducted by Julian Romero, ſo contrary to the expectation of Don Lewis, the great Commander and Lieutenant of the Netherlands for the King of Spaine, as he came to the bancks of Bergen to behold the ſlaughter of the Zeelanders. But, contrary to his expectation, he beheld his Armado, ſome of them ſunck, ſome of them thruſt on the ſhoare, and moſt of the reſt maſtered and poſſeſſed by his enemies; inſomuch as his great Captain Romero with great difficulty, ſome ſay in a ſkiffe, ſome ſay by ſwymming, ſaved himſelfe.

The like ſucceſſe had Captaine Werſt of Zeeland againſt the fleet which tranſported the Duke of Medina Cœli, who was ſent out of Spaine by ſea to governe the Netherlands in place of the Duke of Alva: for with twelve Crumſters or Hoyes of the firſt troope of 21 ſayle, he tooke all but three, and he forced the ſecond (being twelve great ſhips filled with 2000 ſouldiers) to run under the Ramakins, being then in the Spaniards poſſeſſion.

II.

EXCELLENT OBSERVATIONS AND NOTES CONCERNING THE Royall Navy and Sea Service.

ADDRESSED TO THE MOST NOBLE PRINCE HENRY, PRINCE OF WALES.

HAVING formerly (moſt excellent Prince) diſcourſed of a maritimall voyage, and the paſſages and incidents therein, I thinke it not impertinent, nor differing from my purpoſe, to ſecond the ſame with ſome neceſſary relations concerning the Royall Navy, with the ſervices and offices thereto belonging. For, as the perfection and excellency of our ſhipping is great and remarkeable, ſo the imperfections and defects of the ſame by uſe and experience of late years have been found to be divers and inconvenient, as it falls out many times in the circumſtances of land-ſervice by the change of armes, diverſities of fortifications, and alteration of diſcipline. And therefore, for the due reformation, many things are neceſſarily and particularly to be ſpoken and conſidered of in their order. In regard whereof I will firſt begin with the officers, and therein crave pardon if (in ſpeaking plainly and truly in a matter of ſo great importance) I doe ſet aſide all private reſpects and partiality: for in that which concerns the ſervice and benefit of my Prince and country, I will ſay with Cicero, *Nil mihi melius, nil mihi charius*; and therefore not juſtly to be taxed with any preſumption for medling with matters wherein I have no dealings nor charge; for that in the affaires of this nature every good ſubject is deeply intereſted, and bound in conſcience and duty both to ſay and doe his beſt.

Of the Officers of the Navy.

FIRST, therefore, it were to be wiſhed, that the chiefe officers under the Lord High Admirall (as Vice-Admirall, Treaſurer, Controller, Surveyor, and the reſt) ſhould be men of the beſt experience in ſea ſervice, aſwell as of judgement and practice in the utinſells and neceſſaries belonging to ſhipping, even from the Battſend to the very Kilſon of a ſhip; and that no kind of people ſhould be preferred to any of theſe offices but ſuch as have been throughly practiſed, and be very judiciall in either kind of the above named ſervices; but we ſee it oftentimes to fall out otherwiſe: for ſometimes, by the ſpeciall favour of Princes, and many times by the mediation of great men for the preferment of their ſervants, and now and then by vertue of the purſe, and ſuch like means, ſome people, very raw and ignorant, are very unworthily and unfitly nominated to thoſe places, when men of deſert and ability are held back and unpreferred, to the great hindrance of his Majeſties ſervice, to the prejudice of the Navy, and to the no little diſcouragement of ancient and noble able ſervitors, when favour or partiality ſhall eat out knowledge and ſufficiency in matters ſo neerly concerning the ſervice and ſafety of the kingdome, wherein all private reſpects ſhould be laid apart, and vertue truly regarded for itſelfe.

Of the Building of Ships.

SECONDLY, it were no leſſe behoovefull for his Majeſties ſervice, and for the ſtrength of the Navy, that no ſhips ſhould be builded by the great, as divers of them have been; for by daily experience they are found to be the moſt weake, imperfect, and unſerviceable ſhips of all the reſt. And it is not otherwiſe to be preſumed, but as the officers would bee thought to be very frugall for his Majeſty in driving a bargaine by the great at a neere rate with the ſhipwright, ſo likewiſe the ſhipwright on his part will be as carefull to gaine by his labour, or at leaſt to ſave himſelfe harmleſſe, and therefore ſuite his worke ſlightly according to a ſlight price: out of the which preſent ſparing and untimely thrift there grows many future inconveniences and continuall charge in repayring and reedifying ſuch imperfect ſlight-built veſſells. The proofe and experience whereof hath been often found in new ſhips built at thoſe rates, but ſo weakly, as that in their voyages they have been ready to founder in the ſeas with every extraordinary ſtorme, and at their returne been enforced to be new built. But ſeeing the officers of the Admiralty doe hold (by the grace of his Majeſtie) places of ſo good credit and benefit, it is their parts, therefore, (being well waged and rewarded for the ſame) exactly to look into the ſound building of ſhips, and to employ their care and travell aſwell in the overſight thereof as to provide that all things elſe belonging to the Navy be good and well conditioned: for the ſtrong and true building of a ſhip is not to be left barely to the fidelity of a marchanticall artificer (the chiefe end of whoſe worke in his owne accompt is his profit and gaine), but ſome ſuperior officer ought to have a further regard in that buſineſſe, if he be ſuch a one as hath more judgment in the building and conditioning of a ſhip, than devotion to his owne eaſe and profit.

Moreover, if any decayed ſhip be intended to be new made, it is more fit and profitable to make her a ſize leſſe than ſhe was than bigger; for then her beams, which were laid over-thwart from ſide to ſide, will ſerve againe, and moſt of her tymbers and other parts will ſay well to the building of a new ſhip; but if ſhe ſhould be made a ſize bigger, the tymber of the old will be unprofitable for that purpoſe: we find by experience, that the greateſt ſhips are leſſe ſerviceable, goe very deep to water, and of marvellous charge and fearefull cumber, our channells decaying every yeare. Beſides they are leſſe nimble, leſſe maineable, and very ſeldome imployed. *Grande navio grande fatica*, ſaith the Spaniard, a ſhip of 600 tons will carry as good ordnance as a ſhip of 1200 tons; and though the greater have double her number, the leſſer will turne her broad ſides twice before the greater can wend once; and ſo no advantage in that overplus of ordnance. And in the building of all ſhips theſe ſix things are principally required.

1. Firſt, that ſhe be ſtrong built.
2. Secondly, that ſhe be ſwift.
3. Thirdly, that ſhe be ſtout ſided.
4. Fourthly, that ſhe carry out her guns all weather.
5. Fifthly, that ſhe hull and try well, which we call a good ſea-ſhip.
6. Sixthly, that ſhe ſtay well, when bourding and turning on a wind is required.

1. To make her ſtrong conſiſteth in the truth of the workeman and the care of the officers.

2. To make her ſayle well is to give a long run forward, and ſo afterward done by art and juſt proportion. For as in laying out of her bows before and quarters behind, ſhe neither ſinck into nor hang in the water, but lye cleare off and above it; and that the ſhipwrights be not deceived herein (as for the moſt part they have ever been), they muſt be ſure that the ſhip ſinck no deeper into the water than they promiſe, for otherwiſe the bow and quarter will utterly ſpoile her ſayling.

3. That ſhe be ſtout, the ſame is provided and performed by a long bearing floore, and by ſharing off above water even from the lower edge of the ports.

4. To carry out her ordnance all weather, this long bearing floore, and ſharing off from above the ports, is a chiefe cauſe; provided alwayes that your loweſt tyre of ordnance muſt lye foure foot cleare above water when all loading is in, or elſe thoſe your beſt pieces

will be of ſmall uſe at the ſea in any growne weather that makes the billoe to riſe, for then you ſhall be enforced to take in all your lower ports, or elſe hazard the ſhip. As beſell to the Mary Roſe (a goodly veſſell), which in the days of King Hen. 8. being before the Iſle of Wight with the reſt of the Royall Navy, to encounter the French fleet, with a ſuddain puff of wind ſtooped her ſide, and tooke in water at her ports in ſuch abundance, as that ſhe inſtantly ſunck downeright, and many gallant men in her. The Captaine of her was Sir George Carew, Knight, who alſo periſhed among the reſt.

5. To make her a good ſea ſhip, that is to hull and trye well, there are two things ſpecially to be obſerved; the one that ſhe have a good draught of water, the other that ſhe be not overcharged, which commonly the King's ſhips are, and therefore in them we are forced to lye at trye with our maine courſe and miſſen, which with a deep keel and ſtanding ſtreake ſhe will performe.

6. The hinderance to ſtay well is the extreame length of a ſhip, eſpecially if ſhe be floaty and want ſharpneſſe of way forwards; and it is moſt true, that thoſe over-long ſhips are fitter for our ſeas than for the ocean; but one hundred foot long, and five-and-thirty foot broad, is a good proportion for a great ſhip.

It is a ſpeciall obſervation, that all ſhips ſharpe before, that want a long floore, will fall roughly into the ſea and take in water over head and ears.

So will all narrow-quartered ſhips ſinck after the tayle. The high charging of ſhips is it that brings them all ill qualities, makes them extreame leeward, makes them ſinck deep into the water, makes them labour, and makes them overſet.

Men may not expect the eaſe of many cabbins and ſafety at once in ſea-ſervice. Two decks and a half is ſufficient to yield ſhelter and lodging for men and marriners, and no more charging at all higher, but only one low cabbin for the maſter. But our marriners will ſay, that a ſhip will beare more charging aloft for cabbins, and that is true, if none but ordinary marryners were to ſerve in them, who are able to endure and are uſed to the tumbling and rowling of ſhips from ſide to ſide when the ſea is never ſo little growne; but men of better ſort and better breeding would be glad to find more ſteadineſſe and leſſe tottering cadge worke. And albeit the marriners doe covet ſtore of cabbins, yet indeed they are but ſluttiſh dens that breed ſickneſſe in peace, ſerving to cover ſtealths, and in fight are dangerous to teare men with their ſplinters.

Of harbouring and placing the Navy,

THERE are alſo many and great reaſons why all his Majeſties Navy ſhould not in ſuch ſort be penn'd up as they are in *Rocheſter-water*, but only in reſpect of the eaſe and commodity of the officers, which is encountred with ſundry inconveniences for the ſea-ſervice, the dificulty being very great to bring them in or out at times of need through so many flats and ſands, if wind and weather be not very favourable. Beſides, they muſt have ſundry winds to bring them to the land's end, and to put them to the ſeas, which oftentimes failes and cauſeth delay when haſt is moſt needfull. For if any ſervice be to be done upon the ſouth parts of England, as the Wight, Portſmouth, the iſlands of Garnſey and Jerſey; or weſtward towards Devonſhire or Cornwall, or towards Wales or Ireland, it is ſo long ere his Majeſties ſhipping can be brought about to recover any of theſe places, as that much miſchiefe may be done the while; for the ſame winds that bring in the enemy binds in our ſhipping in ſuch ſort, as that oftentimes in a month's ſpace they are not able to recover the neereſt of any of theſe above-named coaſts. But how perillous a courſe it is, is eaſily diſcerned and as eaſily remedied, ſeeing there are beſides ſo many ſafe and good harbours to diſperſe and beſtow ſome of the Navy in, where they may ever lye fit for all ſervices; as Portſmouth, Dartmouth, Plymouth, Falmouth, Milford, and divers others; all of them being harbours very capable and convenient for ſhipping. But perhaps it will be alleadged that they cannot ride in any of theſe ſo ſafe from enemies as in Rocheſter-water, becauſe it reacheth far within the land, and is under the protection of ſome blockhouſes. To which I anſwer this; That with very eaſie care and proviſion they may in moſt of theſe places ride ſufficiently ſecure from any forraine practices. And I doe not mean that all the whole Navy ſhould be ſubdivided into all theſe ports, but that ſome halfe dozen or eight of the midling ſhips and ſome pynnaces ſhould lye in the weſt, and yet not in any port ſo neere the ſea as that in a darke night they may be endangered by enemies with fire or otherwiſe, but in ſome ſuch places as Aſhwater is by Plymouth, where an enemy muſt run up a freſh river a dozen miles after he hath paſſed the forts of the iſland, and the alarum given before he can come where they lye at anchor; in which river the greateſt charack of Portugall may ride a-float ten miles within the forts. But if regard be only had of their ſafe keeping, and not alſo of their readineſſe and fitneſſe for ſervice, then let them never be ſent abroad to be hazarded againſt the enemies forces; for therein they ſhall be more ſubject to caſualitie and danger than by lying in any of theſe harbours above ſpecified. But certaine it is that theſe ſhips are purpoſely to ſerve his Majeſty, and to defend the kingdom from danger, and not to be ſo penn'd up from caſualitie, as that they ſhould be the leſſe able or ſerviceable in times of need; and therefore that objection favours not of good reaſon but rather of ſelfe-reſpect in the officers, who are all for the moſt part well ſeated neer about Rocheſter. But the ſervice of his Majeſty and the ſafety of the realm (in my poore opinion) ought to prevaile beyond all other reſpects whatſoever: and to him that caſts thoſe needleſs doubts, it may well be ſaid, *pereat qui timet umbras.*

Of the needfull Expence in manning the Navy, and other Inconveniences, by placing all the Fleet in Rocheſter-Water.

IF the ſervice of the ſhipping lying for any of theſe places above-named, or for Spaine, or for the iſlands, they are enforced of very neceſſity to preſſe the beſt and greateſt part of their men out of the weſt countries, which is no ſmall charge in bringing them ſo far as between that and Rocheſter; and then when they are imbarqued at Rocheſter, their charge is againe redoubled in their pay and expence of victualls before the ſhips can recover ſo farre as Plymouth, which many times is long a doing, for they doe ever uſually touch at Plymouth in all ſoutherne voyages for the furniſhing many ſea-neceſſaries which that country doth afford; and therefore for ſo many ſhips as ſhould be there reſident, the charges of conduct money for marryners, of wages, and of victualls, would be well ſaved for all that time which is ſpent betwixt Rocheſter and Plymouth. Beſides, it were to be preſumed, that enemies would not be ſo troubleſome to the weſterne coaſts, nor that country itſelf would be ſo often diſmayed with alarums as they have of late years been, if ſome of his Majeſties good ſhips were reſident in thoſe parts. If therefore in his Majeſties wiſdome it ſhould appeare fit to beſtow ſome of his ſhipping in any of theſe harbours aforenamed, it ſhall be very needful likewiſe that there be a magazin of all manner of neceſſary proviſions and munitions in the ſame places, according to the proportion of the ſhipping that there ſhall be reſident, whereby ſuch defects as by accident may fall out, ſhall upon any occaſion be readily ſupplyed without delays or hindrance of ſervice; and that withall in the ſame places ſome officers belonging to the Admiralty be there alwayes attendant, otherwiſe it would be found very inconvenient to be enforced ever to attend ſuch helps and ſupplies as muſt come ſo far off as London, when it may more eaſily and with leſſe charge be effected in places where they ride.

Of great Ordnance.

IT was alſo very behoovefull that his Majeſties ſhips were not ſo overpeſtered and clogged with great ordnance as they are, whereof there is ſuch ſuperfluity, as that much of it ſerves to no better uſe but only to labour and overcharge the ſhips ſides in any growne ſeas and foule weather. Beſides, many of the ſhips that are allowed but twenty gunners, have forty piece of braſſe pieces, whereas every piece at leaſt requires foure gunners to attend it, and ſo that proportion of ordnance to ſo few gunners very prepoſterous: for when a ſhip ſeeles or roules in foule weather, the breaking looſe of ordnance is a thing very dangerous, which the gunners can hardly prevent or well looke into, they being ſo few, the gunnes ſo many; withall we doe ſee, that twenty or thirty good braſſe pieces, as cannon, demicannon, culverin, and demiculverin, is a royall batterie for a Prince to bring before any towne or ſtrong fortreſſe. And why ſhould not we aſwell thinke the ſame to be a very large proportion for one ſhip to batter another withal? which if it be, then may his Majeſty ratably ſave a great part of the ordnance throughout every ſhip, and make the Navy the more ſufficient and ſerviceable, and thereby alſo ſave a great deale of needleſſe expence in ſuperfluous powder and ſhot, that is now pretended to be delivered out according to this huge and exceſſive proportion of artillery; whereof if many had not been ſtricken downe into Holt in many voyages (and eſpecially in this laſt journey to the iſlands), divers of the ſhips weight, heaſt, and charge thereof, would have foundered in the ſea: wherein I report me to ſuch as have ſerved in them, and ſaw the proofe thereof. For this journey to the iſlands did, moſt of all others, diſcover unto us theſe experiences and tryalls in the Royall Navy, for that it was the longeſt navigation that ever was made out of our realme, with ſo many of the Princes ſhips, and tarrying out ſo late in the year, whereby both the winds and ſeas, had power and time throughly to ſearch and examine them. Beſides, many times there is no proportion of ſhot and powder allowed rateably by that quantity of the great Ordnance, as was ſeen in the ſea-battaile with the Spaniards in the yeare 88, when it ſo neerly concerned the defence and preſervation of the kingdome. So as then many of thoſe great guns wanting powder and ſhot ſtood but as cyphers and ſcarecrowes, not unlike to the Eaſterling hulkes, who were wont to plant great red port-holes in their broadſides, where they carryed no Ordnance at all.

Of Calking and Sheathing his Majeſties Ships.

THERE is a great error committed in the manner of calking his Majeſties ſhips, which being done with rotten ocum is the cauſe they are leaky; and the reaſon is this, for that they make their ocum wherewith they calke the ſeams of the ſhips of old ſeere and weather-beaten ropes, when they are overſpent and growne ſo rotten, as they ſerve for no other uſe but to make rotten ocum, which moulders and waſhes away with every ſea, as the ſhips labour and are toſſed; whereas indeed of all other things, the moſt ſpeciall and beſt choice would be made of that ſtuffe to have it both new and good, for that ſparing to imploy old rotten ropes is a great defect either in the building of new ſhips or in the repairing of old, and is the cauſe why after every journey they muſt be new calked; and therefore it were much to be wiſhed, as a thing fit for his Majeſties ſervice, profitable for the Navy, and happy for thoſe that ſhall ſerve in them, that the whole Navy throughout were all ſheathed, as ſome of them are. The benefit and good whereof for ſea-ſervice is manifold, and no leſſe frugall for his Majeſty in making his ſhips as ſtrong and laſting thereby, as they are otherwiſe good of ſayle: and then ſhall they never need (ſcarcely once in ten years) this new calking and repayring which now almoſt every yeare they have. And hereof let the cenſure be taken of the beſt ſeamen of England, and they will not vary from this opinion.

Of Victualling.

AS his Majeſties due allowance for victualling of ſhips is very large and honourable, and would be greatly to the incouragement and ſtrengthning of the marriners and ſouldiers that ſerve in them if it were faithfully diſtributed, the ſea-ſervice (indeed) being very miſerable and painfull, ſo againe as it is abuſed and purloyned it is very ſcant and diſhonourable, to the great ſlander of the Navy, to the diſcouragement of all them that are preſt thereunto, and to the hinderance of his Majeſties ſervice; for that many times they goe with a great grudging to ſerve in his Majeſties ſhips, as if it were to be ſlaves in the gallyes, ſo much doe they ſtand in feare of penurie and hunger; the caſe being cleane contrary in all merchants ſhips; and therefore the purveyors and victuallers are much to be condemned as not a little faulty in that behalfe, who make no little profit of thoſe polings, which is cauſe very lamentable, that ſuch as ſit in eaſe at home ſhould ſo raiſe a benefit out of their hunger and thirſt that ſerve their Prince and country painfully abroad, whereof there hath a long time been great complaining but ſmall reformation.

Of Beere Caſkes.

THERE is alſo daily proofe made what great inconveniences growe by the bad caſke which is uſed in his Majeſties ſhips, being commonly ſo ill ſeaſoned and conditioned, as that a great part of the beere is ever loſt and caſt away, or (if for neceſſity it be uſed) it breeds infection and corrupts all thoſe that drinke thereof: for the victuallers, for cheapneſſe, will buy ſtale caſke that hath been uſed for herring, traine oyle, fiſh, and other ſuch unſavory things, and thereinto fill the beere that is provided for the King's ſhips. Beſides, the caſke is commonly ſo ill hooped, as that there is waſt and leaking made of the fourth part of all the drinke, were it never ſo good; which is a great expence to his Majeſty, a hinderance of ſervice, and a hazard of men's lives, when the proviſion failes ſo much and anſwers not the accompt; the which might eaſily be redreſſed, if the caſke for his Majeſties ſhipping were purpoſely hooped in ſuch ſort as wine caſke is, or elſe hooped with iron, which would ever ſerve and ſave that continuall proviſion of new caſke which now falls out every voyage. But this courſe were more profitable for his Majeſty than for his officers, and therefore unpleaſing to be ſpoken of; but yet ſuch as ſerve in the ſhips have good cauſe to wiſh the reformation thereof.

Of the Cookroomes in his Majeſties Ships.

AND whereas now the cookroomes in all of his Majeſties ſhips are made below in hold in the waſt, the inconveniences thereof are found many wayes by daily uſe and experience. For firſt it is a great ſpoile and annoyance to all the drinke and victualls which are beſtowed in the hold by the heat that comes from the cookroome; beſides, it is very dangerous for fire, and very offenſive with the ſmoake and unſavory ſmells which it ſends from thence. Moreover it is a great weakening to a ſhip to have ſo much weight and charge at both the ends and nothing

thing in the mid-ſhip, which cauſeth them to warpe, and (in the ſea-phraſe, and with marriners) is tearmed camberkeeld; whereas if the cookroomes were made in the forecaſtle (as very fitly they might be) all thoſe inconveniences above ſpecified would be avoyded, and then alſo would there be more roome for ſtowage of victuals, or any other neceſſary proviſions, whereof there is now daily found great want. And the commoditie of this new cookroome the merchants have found to be ſo great, as that in all their ſhips (for the moſt part) the cookroomes are built in their forecaſtles, contrary to that which hath been anciently uſed. In which change, notwithſtanding, they have found no inconvenience to their dreſſing of meat in foule weather, but rather a great eaſe, howbeit their ſhips goe as long voyages as any, and are for their burdens aſwell mann'd. For if any ſtormes ariſe, or the ſea grow ſo high as that the kettle cannot boyle in the forecaſtles, yet having with their beere and biſket, butter and cheeſe, and with their pickled herrings, oyle, vinegar, and onions, or with their red herrings and dry ſprats, oyle and muſtard, and other like proviſions that needs no fire, theſe ſupply and varieties of victuals will very ſufficiently content and nouriſh men for a time, until the ſtorme be overblowne that kept the kettle from boyling.

Of muſtering and preſſing able Marriners.

AS concerning the muſters and preſſes for ſufficient marriners to ſerve in his Majeſties ſhips, either the care therein is very little or the bribery very great, ſo that of all other ſhipping his Majeſties are ever the worſt manned; and at ſuch times as the Commiſſioners commiſſions come out for the preſſing of marriners, the officers doe ſet out the moſt needy and unable men, and (for conſiderations to themſelves beſt knowne) doe diſcharge the better ſort; a matter ſo commonly uſed, as that it is growne into a proverbe among the ſaylers, that the muſtermaſters doe carry the beſt and ableſt men in their pockets; a cuſtome very evill and dangerous where the ſervice and uſe of men ſhould come in tryall: for many of thoſe poore fiſhermen and idlers that are commonly preſented to his Majeſties ſhips are ſo ignorant in ſea-ſervice, as that they know not the name of a rope, and therefore inſufficient for ſuch labour. The which might eaſily bee redreſſed, if the Vice-Admirall of the ſhire where men are muſtered, and two Juſtices, had directions given to joyn with the muſtermaſters for the preſſing of the beſt men whom they well know, and would not ſuffer the ſervice of their Prince and country to be bought and ſold as a private muſtermaſter would doe. Beſides, the Captains themſelves of the ſhips, if they bee bare and needy (though pitty it were that men of ſuch condition ſhould have ſuch charge committed unto them) will oftentimes for commodity chop and change away their good men; and therefore it were fitly provided to bridle ſuch odd captains, that neither they themſelves nor any of their men ſhould receive his Majeſties pay but by the pole, and according as they were ſet downe in the officers books when they were delivered, without changing of any names, except to ſupply ſuch men as are wanting by death or ſickneſſe, upon good teſtimonie under the hands of the maſter, the boatſwayne, the maſter gunner, the purſer and other officers of the ſhip; for it neerly concerns them to looke well thereunto, having daily uſe of them.

Of Arms and Munition.

IT were a courſe very comfortable, defenſive, and honourable, that there were for all his Majeſties ſhips a proportion of ſwords, targets of proof, moryons, and curatts of proofe, allowed and ſet downe for every ſhip according to his burthen, as a thing both warlike and uſed in the King of Spain's ſhips, the want whereof as it is a great diſcouragement to men if they come to any neere fight or landing, ſo would the uſe thereof be a great annoyance and terrifying to the enemy. And herein ſhould his Majeſty need to be at no extraordinary expence; for the abating of the ſuperfluous great pieces in every ſhip, with their allowance for powder, match, and ſhot, would ſupply the coſt of this proviſion in very ample manner.

Of Captains to ſerve in his Majeſties Ships.

AT all ſuch times as his Majeſties ſhips are imployed in ſervice, it were very convenient that ſuch gentlemen as are his Majeſties owne ſworne ſervants ſhould be preferred to the charge of his Majeſties ſhips, choice being made of men of valour and capacitie rather than to imploy other men's men; and that other of his Majeſties ſervants ſhould be diſperſed privately in thoſe ſervices to gaine experience, and to make themſelves able to take charge; by the which means his Majeſtie ſhould ever have gentlemen of good accompt his owne ſervants, captains of his owne ſhips, inſtead of pettie companions and other men's ſervants who are often imployed, being (indeed) a great indignity to his Majeſty, to his ſhipping, and to his owne gentlemen. For that in times paſt it hath been reputed a great grace to any man of the beſt ſort to have the charge of the Prince's ſhip committed unto him, and by this means there would ever be true report made unto the Prince what proceedings are uſed in the ſervice, which theſe meaner ſort of Captains dare not doe for feare of diſpleaſing the Lords their Maſters, by whom they are preferred, or being of an inferiour quality have no good acceſſe to the preſence of the Prince, whereby to have fit opportunity to make relation accordingly.

But now foraſmuch as I doubt not but that ſome contrary ſpirits may or will object this is a ſufficient reaſon to infirme all thoſe points that I have formerly ſpoken of, and ſay unto me, Why ſhould his Majeſtie and the State bee troubled with this needleſſe charge of keeping and maintaining ſo great a Navy in ſuch exquiſite perfection and readineſſe, the times being now peaceable, and little uſe of armes or ſhips of warre either at home or abroad, but all ſafe and ſecure aſwell by the uniting of the two nations as by the peace which we hold with Spaine and all other Chriſtian Princes? To this I anſwer, That this (indeed) may ſtand (at the firſt ſight) for a prettie ſuperficiall argument to bleare our eyes, and lull us aſleep in ſecurity, and make us negligent and careleſſe of thoſe cauſes from whence the effects of peace grows, and by the vertue whereof it muſt be maintained. But we muſt not flatter and deceive ourſelves to thinke that this calme and concord proceeds either from a ſetled immutable tranquillity in the world (which is full of alterations and various humours), or from the good affections of our late enemies, who have taſted too many diſgraces, repulſes, and loſſes, by our forces and ſhipping, to wiſh our State ſo much felicity as a happy and peaceable Government, if otherwiſe they had power to hinder it. And therefore though the ſword be put into the ſheath, we muſt not ſuffer it there to ruſt, or ſtick ſo faſt, as that we ſhall not be able to draw it readily when need requires; for albeit our enemies have of late years ſought peace with us, yet hath it proceeded out of the former tryall of our forces in times of war and enmity. And therefore we may well ſay of them as Anneus (Pretor of the Latines) ſaid of the Roman Ambaſſadours, who ſeemed curious and carefull to have the league maintained betweene them (which the Roman Eſtate was not accuſtomed to ſeeke at their neighbours hands) and thereupon, ſaith this Anneus, *unde hæc illis tanta modeſtia niſi ex cognitione virium & noſtrarum & ſuarum.* For with the like conſideration and reſpect have our late enemies ſought to renew the ancient friendſhip and peace with us. And well we may be aſſured, that if thoſe powerfull means whereby we reduced them to that modeſty and curteſie as to ſeeke us were utterly laid aſide and neglected, ſo as we could not againe upon occaſion readily aſſume the uſe and benefit of them as we have done, thoſe proud maſtering ſpirits, finding us at ſuch advantage, would be more ready and willing to ſhake us by the ears as enemies than to take us by the hands as friends. And therefore far be it from our hearts to truſt more to that friendſhip of ſtrangers, that is but diſſembled upon policy and neceſſity, than to the ſtrength of our owne forces, which hath been experienced with ſo happy ſucceſſe. I confeſſe that peace is a great bleſſing of God, and bleſſed are the peacemakers, and therefore doubtleſſe bleſſed are thoſe means whereby peace is gained and maintained; for well we know that God worketh all things here amongſt us mediatly by a ſecondary means, the which meanes of our defence and ſafety being ſhipping and ſea-forces, are to be eſteemed as his guifts, and then only availeable and beneficiall, when he withall vouchſafeth his grace to uſe them aright.

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SUPPLEMENT.

NAVAL COMMUNICATIONS.

No. I.

To Mr. SEWELL.

Schleſwig, Denmark, October 31, 1791.

DEAR SIR,

HAVING duly received the packet containing the two Numbers of the EUROPEAN MAGAZINE, where I was not a little ſurpriſed to find my laſt letter in print, and the Plan and Rules for the SOCIETY for the IMPROVEMENT of NAVAL ARCHITECTURE, I might long ſince have returned you my moſt hearty thanks, had it not been for a number of journies I had to make all this ſummer, and for not having been able to communicate ſooner to you the reſult of my endeavours to promote your moſt uſeful Plan. The firſt ſtep I made was to apply to the King's Brother-in-law, and Father to the new Princeſs Royal, PRINCE CHARLES OF HESSE, preſenting him with a copy of the Plan and Propoſals, and ſoliciting his patronage for the promoting it amongſt the Lords, and Gentlemen of the Navy. The Prince informed me, by means of a very polite letter, of the great pleaſure he had received from the communication I had made him; and that he ſhould think it a duty incumbent on him to promote the deſign of that moſt reſpectable and uſeful Society. According to this anſwer, Mr. DE STIJBOLD, Maſter of the Fabric, under whoſe direction the building of ſhips is carried on in the King's Dock-yard at *Copenhagen*, told me in a letter, dated *Oct.* 4th, that with the greateſt ſatisfaction he had heard of the Plan formed by the Society, who might be looked upon as highly uſeful, not only to *England*, but alſo to other Maritime Powers, as there could be no doubt but that the noble-minded *Engliſhmen* would rejoice in aſſociating with other nations to execute a plan of the firſt importance to the human ſpecies; and that he ſhould therefore be very happy, whenever occaſion ſhould be given, to offer that moderate ſhare of knowledge he was poſſeſſed of, provided that our Government would not look upon it as contrary to the duty of the ſtation he was deemed worthy to hold. To give further proofs of his readineſs to enter into the Society's deſign, Mr. DE STIJBOLD offers them a copy of a Treatiſe he wrote ſome time ago on *Keelbreaking*, which obtained the Premium of the Royal Society at *Copenhagen*. This Gentleman's capacity being holden in great eſteem in this country, I think a production of his pen muſt be very welcome to the Society; and accordingly I deſired him to ſend the Treatiſe under your addreſs with the firſt veſſel ſailing to *London*. If it ſhould happen not to be of any uſe to you, it being written in the *Daniſh* tongue, you may return it to *Copenhagen* to get it tranſlated there, though that would make you incur ſome expences. In the latter caſe the author offers himſelf to reviſe the tranſlation, and to clear it from faults which poſſibly might have crept into it. I am very happy to have given you ſome little proof of my zeal in this affair. I muſt intreat you to furniſh me further with the means of ſhewing my dutiful acknowledgements to you, as well as my hearty concurrence to an undertaking worthy of a moſt reſpectable nation, and uſeful to my native country and the whole human race.

My time having been divided between travelling and doing buſineſs at home, I have not had it in my power to collect thoſe biographical accounts which I am bound by promiſe to furniſh you with; but I only beg a new prolongation of your patience. The only news I can tell you from *Denmark* are, that our great men are going on pretty well with the reform of our Finances, which but ſome years ago were in a very alarming confuſion; that the celeſtial light of Philoſophy and Philanthropy is ſpreading itſelf from the Cabinet to the ſtraw-thatched Cottages of our Country-people, whoſe fate has been, and ſtill more will be alleviated by the benevolent ardour of COUNT DE REVENTLOW, Preſident of the Chamber.

My beſt compliments to all your and my friends. I am, with the greateſt eſteem,

Your ſincere friend and ſervant,
T. W. O.

P. S. I beg the continuation of the Parliamentary Regiſter and the European Magazine.

No. II.

IMPRESSING OF SEAMEN.

To Mr. SEWELL.

SIR,

YOUR Magazine has firſt ſtarted the idea, and in it have been depoſited the rudiments of a ſyſtem to which future Britons ſhall look back with admiration and gratitude: I mean the patriotic Plan for the Improvement of our Naval Architecture. It may now, Sir, be in your power, perhaps, to add to the *applauſes* the *bleſſings* of your countrymen; and as you have contributed to their ſtrength, you may alſo ſubtract from their miſery. What I would recommend to your notice, and, through your means, to that of the Public, is *the violent and diſgraceful mode of recruiting our navy* in caſes of war or apprehenſion, which continues to be the complaint and ſcandal of theſe enlightened times. The enormity and peculiar diſtreſſes inſeparable from this practice have been felt and acknowledged by all parties; and a few well-meant but deſultory efforts have been made to remedy the grievance. The failure of what little has been offered it will not perhaps be very difficult to account for. Hitherto all that has been attempted will be found amongſt the benevolent but ſolitary deſigns of unconnected individuals. It has been taken up by no body of men either as a ſubject for animadverſion, or as a grievance for abolition: it has attracted no communication of ſentiments, no contribution of ſubſcriptions: involving in its proceſs and effects the moſt diſtreſſing outrages on private happineſs, the great principles of civil liberty, and the deareſt rights of Britons—it is yet a cauſe without ſupport and without diſcuſſion; without a Patron to lead or a Society to maintain.

Now, Sir, by opening your valuable publication to this ſubject, you will have an opportunity of obviating many, if not all, of the impediments that have hitherto obſtructed this deſirable reform. A ſtation by this means will be ſecured conſpicuous enough to attract the attention of the public, and of reſpectability ſufficient to allure the abilities of thoſe who are competent to engage in the cauſe; a centre of union will be obtained to which candid and uſeful communications may be directed; and the ſpark once emitted may produce light enough to direct to ſome remedy, which will at laſt be deemed morally and politically adequate to the cure, and which may ſilence the complaints of the individual without injuring the intereſts of the community.

The Society already formed has declared, that its views are not narrowed to the mere ſubject of the title they have adopted, but that they will, with liberality, receive any information on ſubjects that are connected with our *maritime affairs*. I will not inſult your underſtanding with attempting to prove the intimate connection which muſt exiſt between our naval armaments and the mode by which they are ſupplied. I have only to ſuggeſt to your opinion and influence a queſtion or two: Would the Society for the Improvement of Naval Architecture incorporate this ſubject into their main deſign? or, Would they refer it to the management of a Committee ſelected for that purpoſe? or, finally, Would it be more adviſeable to ſtart Propoſals for an entire new Society to bring this ſubject into conſideration and activity?

I have the pleaſure to affirm to you, that there is a gentleman, one whoſe name and benevolent exertions will go down to poſterity in the ſame claſs with thoſe of a HANWAY and a HOWARD, who intends taking a laborious part in this buſineſs. His great abilities and the beſt part of his youth have been, and are now, dedicated to remove an evil of enormous magnitude, but which has not yet been accompliſhed. From ſuch a character every aſſiſtance may be expected. His connections, eſtimation, and, above all, his indefatigable activity, will render him a valuable aſſociate in ſuch a work. The Writer of this Letter (having been a profeſſional man, and now enjoying leiſure and ſome opportunity of obſervation) received a requeſt from him to turn his thoughts to this ſubject. What has reſulted from ſuch a ſtudy, ſhould the buſineſs meet your encouragement, ſhall be readily communicated. Therefore, leaving the diſpoſal of this application to your opinion and judgment, and without endeavouring more to enhance what you will, no doubt, ſee in a proper light,

I remain, Sir,
Your humble ſervant,
J. F. S.

☞ *The Writer of this Letter will find ſome good Hints in "VIEW of NAVAL FORCE of BRITAIN."*

No. III.

To Mr. SEWELL.

Sir,

LOOKING over ſome old papers which belonged to a friend of mine, I found the following remark: if it will be of any ſervice to you or your friends, I ſhall be happy.

In my courſe of ſervice in the navy I have made the remark, as well as many others, that the maſts of men of war in general are longer than they ſhould or ought to be. Let us examine the different modes of maſting, and try if we cannot find out a middle mode which will do better for practice, perhaps, than either of the two. What I am going to point out, is only a correction to the general mode made uſe of in maſting men of war.

Take the extreme length of the lower gun-deck, the extreme breadth from out to out, with the depth of the hold; add all theſe together, from which ſubtract the height of the main-ſtep; this number divided by ſix gives the length of the main-maſt in yards (or divided by two in feet): and for the diameter of the main-maſt in the partners, allow one inch for every yard the maſt is long—for a firſt rate.

Now let us ſuppoſe a firſt-rate's lower gun-deck is 190 feet, the extreme breadth is 53 feet, depth in the hold 22 feet, and the height of the main-ſtep 3 feet.

Extreme length of the lower gun-deck -	190 feet
Extreme breadth from out to out - -	53
Depth in the hold - - -	22
	265
The height of the main-ſtep which I ſubtract -	3
	6) 262
The length of the main-maſt in yards -	43 8 inch.
The length of the main-maſt in feet -	131

If we allow one inch for every yard the maſt is long for the diameter in the partners, the maſt will be 43 inches, &c.

Now the ſecond method made uſe of by a very good maſt-maker, was to take the extreme length of the lower gun-deck, and extreme breadth from out to out, and add them together, and take the half for the length of a main-maſt in feet, and the diameter in the partners one inch per yard the maſt was long.

The

The extreme length of the lower deck	190 feet
The extreme breadth from out to out	53
	2) 243
The length of the main-maſt in feet	122
The length of the main-maſt in yards	40 6 inch.

Between theſe two methods there is a great difference, nearly 10 ft. Perhaps the one was uſed for men of war, the other for merchantmen. If the former is uſed for men of war, the maſt will be, I think, too long; and I believe they are generally maſted by the firſt method. Now, ſuppoſe we think the firſt method the beſt, and take it, then the length of the main-maſt will be 131 feet, &c. Now I will ſuppoſe this to be the generally-allowed length of the main-maſt for a firſt-rate, but in my opinion it is too long.

The methods cuſtom has eſtabliſhed to maſt men of war may be various, yet I only mention theſe two as, perhaps, the moſt common. I have often conſidered the figure or form of a ſhip's bottom, and have been led to think, that in maſting of ſhips we ought to know how they ſet on the water totally light and full loaded, or as they go beſt at ſea; this muſt be the effect of experience and obſervation. What I mean is, to know the difference of the draft of water forward and aft in theſe two different ſituations, when a ſhip is light and when ſhe is in full trim, or as ſhe goes beſt at ſea. To make you underſtand me more clearly, I will ſuppoſe a ſhip juſt off the launch, which ſets 3 feet 6 inches or 4 feet more by the ſtern than the head when light, in a contrary ſituation when loaded, and in her beſt trim ſhe goes beſt at ſea I ſuppoſe at 18 inches only by the ſtern. Now this difference in her floating I would ſtrike off from the firſt, and I ſuppoſe common, method of finding the length of a main-maſt.

N. B. All maſts, in my opinion, ſhould ſtand perpendicular, as that is the beſt poſition and is the moſt favourable, and will ſtrain the ſhip the leaſt at ſea, &c. &c.

Now, by the firſt method, the mainmaſt is	131 feet
By the ſecond method	122
	253
The mean of the two methods	126 6 inch.

Now the difference of her floating light when off the launch forward and aft is 3 feet 6 inches; but ſhe goes beſt at ſea, as found by experience and obſervation, at only 18 inches difference between the draft of water forward and aft. Now this difference of trim or floating between being loaded and light, &c. I would take off the length of the main-maſt, if it is found by the firſt method, &c. &c.

The difference of the draft of water forward and aft when light is, I ſuppoſe, 3 feet 6 inches: but ſhe goes beſt at ſea in full trim at only, I ſuppoſe, 1 foot 6 inches: this laſt I ſubtract from the former, and the difference which remains I alſo ſubtract from the common allowed length of a main-maſt if found by the firſt method, &c. &c.

	Ft.	Inch.
Forward and abaft when light - -	3	6
Forward and aft as ſhe goes beſt at ſea when in trim, ſubt.	1	6
This remainder I ſubtract off from the common allowed length of a main-maſt by the firſt method	2	0

So that the main-maſt by my method would be 129 feet inſtead of 131 feet.

N. B. This might be made a general correction for maſts in the navy.

By the firſt method a main-maſt's length is -	131 feet.
By the ſecond method, is - - -	122
By my method, is - - -	129
	3) 382
The mean of all the three methods is - -	127 4

By the firſt method I think the main-maſt is too long; the ſecond I do not make uſe of, only as to take it with the others to find a mean of all three, and to ſhew how mine differs from that mean, which is 1 ft. 8 inch.; whereas by the firſt and ſecond methods there is a difference of near 10 ft.; by mine and the firſt only 2 ft. and mine and the mean of the three only 20 inches. Perhaps the mean of the whole would be the beſt, 127 ft. 4 inch. for the length of ſuch a ſhip's main-maſt. If the ſhips in his majeſty's ſervice are maſted by the firſt method, which I believe they are, the main-maſt will be too long; and this is generally allowed, that the maſts in the navy are too long, by every officer of experience and obſervation in the ſervice. Now as I believe a main-maſt in moſt ſhips is the firſt mover, conductor, or director, &c. &c.; as every maſt and yard in the ſhip is made by it in certain proportions, &c. we may conclude, if the firſt director is out of proportion all the reſt will be ſo; this will increaſe the weight aloft and ſtrain the ſhip, &c. &c. For my own part, I think ſhips in the king's ſervice ſhould be maſted as I adviſe. Information and experience will teach us how they go beſt at ſea, and the difference of their ſetting in the water light and loaded, or as they go beſt, in my opinion ought to be attended to; ſuch an experiment would be worthy of a trial: but this I am in no hopes of ſeeing put in practice while I am alive. A SEAMAN.

The Brunſwick off the launch ſet at 13 feet forward, and by the ſtern 16 ft. 6 inch.; the difference forward and aft was 3 ft. 6 inch. The Windſor-Caſtle off the launch ſet forward at 13 ft. 9 inch. aft, 17 ft. 9 inch. How theſe ſhips will go beſt, experience will ſhew. Some of the beſt ſailing ſhips in his Majeſty's ſervice generally, I believe, go beſt in full trim from 18 to 21 or 22 inches by the ſtern, &c. &c.

P. S. If this is worth your notice you may keep it; if not burn it, or do with it what you think proper.

I remain with reſpect, &c.
Your humble ſervant, &c. &c.
A SEAMAN.

No. IV.

To the EDITOR of the EUROPEAN MAGAZINE.

SIR,

YOUR Correſpondent who has with more warmth than ſtrength of argument replied to two letters of mine which appeared on the cover of your Magazine, having adopted the ſignature of BOREALIAN, I hope, as the word is long, will pardon the liberty I ſhall take in abbreviating it to the more familiar appellation of *Borée*.

Being as deſirous as Mr. *Borée* can be that the Society for the Improvement of Naval Architecture may not be miſled, I cannot refrain from the attempt to refute his charges and controvert his aſſertions. I muſt premiſe that my opponent has rather deviated from the purport of what I aſſerted, by ſetting up his ſtandard at Liverpool and Lancaſter; becauſe the ſhips which I alluded to were ſuch as are in London commonly known and uſually diſtinguiſhed by the term of "North-Country built," which the river Thames is ſupplied with from Newcaſtle, Stockton, Whitby, and other ports on the N. E. coaſt of England. But I do not however admit, that thoſe of the N. W. coaſt are much better either in point of materials or workmanſhip. Mr. *Borée* aſks, "*Is not mountain mahogany of a firmer texture than that* "*produced in the flatter countries? Is it not ſo with oak?*" I anſwer, it is by no means ſo with oak; the ſoil of mountains being uſually rocky and hard, which ill ſuits the growth of that wood, whoſe principal ſtay is its tap-root, which deſcends in a perpendicular direction, and therefore the oak delights in a deep loam or clay where that tap-root meets with leaſt obſtruction; for it is obſervable, that where ſtony or hard ground obſtructs its progreſs, or diverts its direction nearer to horizontal, the tree is ſtunted; and for want of that deep hold of the earth generally ſhaky or otherwiſe defective. In ſhort, an oak arriving ſooner at maturity, is a proof that the ſoil is more adapted to the production of it; and it is well known, that where oak thrives moſt quickly, the quality is found to be the beſt. The climate too has much influence; for as Mr. *Borée* draws his compariſon from mahogany, he will find that that and all other very hard woods are produced in the torrid zone, while thoſe of the ſofteſt ſpecies grow nearer the poles: and indeed the gradation ſeems very regular; not in the different ſpecies only, but even in the different degrees of quality in each ſpecies. The foreign oak with which we are ſupplied comes chiefly from Dantzick and Stettin, further North by a few minutes only than Lancaſter and Liverpool. The quality, however, of this oak is univerſally admitted to be much inferior to that of the Engliſh, which is chiefly conſumed in the port of London, and which is moſtly brought from the ſouthern counties. Several attempts have been made to bring timber from the north of England for the ſupply of the London market; but it has been found of ſo indifferent quality, as to be refuſed by the builders; ſeveral of whom have, at different times, had a freight of it by way of ſample, but none have contracted for any quantity after ſuch ſamples had opened their eyes. The oak of Eſſex even is known to be inferior to that of Suſſex and Hampſhire. Since then it appears evident, that an increaſe of latitude, or its conſequent diminution of the ſun's influence depreciates the quality of this wood, it muſt follow, that the oak of Lancaſhire cannot be ſo good as that of Suſſex, Kent, or Hampſhire. The fact, however, is ſufficiently eſtabliſhed among practical men, not to have required any elucidation from argument.

As to the article of plank (in ſolution of my imputed paradox), I muſt aſſert, that the ſhips which bring coals from the northward to the ports of Suſſex and Hampſhire, &c. ſeldom fail to load back with plank and treenails, if they can procure them; and that they take ſuch as are unſaleable to the London conſumers. I admit that they have *ſtoves* in many of the North-Country yards for burning the plank; which being a very tedious operation compared with that of boiling it in the more expenſive kilns of the River yards, proves my aſſertion, that the former cannot execute their work with that diſpatch which the latter afford.

I by no means charged the Northern builders particularly with ſeducing ſhipwrights from the Thames; my aſſertion went no further than that a conſiderable number of the ſhipwrights who worked on thoſe ſhips of war which were built by contract in the country, were ſeduced from the river Thames; an aſſertion which may be verified from the oral teſtimony of many of thoſe ſhipwrights.

As to Mr. *Borée*'s N. W. nurſery for ſhipwrights, I muſt maintain, that thoſe reared in it are, with few exceptions, much inferior in abilities to thoſe who have ſerved their apprenticeſhip in the river Thames; and indeed moſt of thoſe few whom my exception favours, have been early tranſplanted, and may be ſaid to have finiſhed their education in the port of London. Mr. *Borée* takes much trouble in defending the iron work of the North; the *quality* of which has not been impeached, though many impartial profeſſional men can eſtabliſh my aſſertion, that it is uſually too ſmall and frequently ill driven.—The partiality which the Navy Board entertains for North-Country built ſhips, ariſes chiefly from their comparative cheapneſs, that honourable Body having been much miſled by a very erroneous ſyſtem of falſe œconomy, which has peculiarly manifeſted itſelf in their contracts for Tranſports; contracts which, as they were taken in the laſt war on exceeding low terms, were conſequently ſhamefully executed, and their reſtrictions notoriouſly eluded. Moſt of the North-Country built ſhips are of that deſcription which come under the denomination of Barks; they are calculated for dry harbours, which they are in the habit of uſing, and conſequently take the ground well; they are likewiſe good ſhips in a ſtorm, having fluſh decks, no heads or galleries, and in ſhort nothing to hold much water: add alſo that their ſterns lay high and their lights are ſmall. But barks are likewiſe frequently built in the Thames; which being more judiciouſly put together with greater attention to ſhift of timber and plank, longer floor-timbers, more dead wood, bolts more in number and larger in ſize, and not only the workmanſhip but the materials alſo of ſuperior quality, muſt be pronounced ſtronger, better, and preferable ſhips for any ſervice to which the former are applicable. This deſcription of ſhips, however, is not generally adopted in the port of London, becauſe they are not calculated for employments where guns for defence, or where roomy and airy accommodations for paſſengers, are required. And as few of the ſhips who go foreign voyages are often laid on ſhore, they are uſually built with a more riſing floor, which renders them more weatherly, and of courſe better ſailers. Captain Cook did certainly prefer North-Country built ſhips, but his *natale ſolum* may be pleaded in defence of the partiality; and I am perſuaded, that if he had been as good a ſhipwright as he was a ſeaman, prejudice, founded on conviction, would have ſupplanted that partiality. Capt. Bligh, who ſailed with Captain Cook (and who, without any diſparagement to the memory of that excellent navigator, is no ways inferior to him), is now on a voyage to Otaheite, &c. in a ſhip built in a yard of the firſt reputation in the River, all his prior voyages to thoſe ſeas having been made in North-Country built veſſels; and as Mr. *Borée* expreſſes an inclination for a wager, I am ready to lay one: That Captain Bligh on his return will decide by giving a preference to the River ſhip. I ſhall take my leave of Mr. *Borée* by aſſuring him, that an ardent deſire of refuting detrimental errors has been the ſole inſtigator of my pen; that I have no concern whatever in ſhip-building, nor have any of my relatives; and that as to any individual advantage expectant from the reſult of our conteſt, I am moſt unequivocally

DISINTERESTED.

No. V.

To the EDITOR *of the* PUBLIC ADVERTISER.

ON SHIP BUILDING.

SIR,

THE encouragement given to inventions in all circumſtances relative to ſhip-building, under the auſpices of the new Society for that purpoſe, if reduced to amuſement and ſpeculation only, will be the ſacrifice of genius without public advantage. Eſtabliſhed perquiſites in the Royal and other naval yards, will probably always ſubdue national emoluments. The following neglected inſtance is a fatal proof of this obſervation. It has been recommended to the Admiralty for ſome years paſt to boil every timber in oil, and then to warp them to their neceſſary purpoſe. This method will ſave the moiety of oak now conſumed; but then the advantage ariſing from a repetition of fees of office will diminiſh, and the ſhipwrights will loſe the plunder of chips, an object they are extremely tenacious about.

The ſame obſtructions will operate againſt any invention to render the Royal Navy more durable, as ſudden rebuildings make quick revolutions of profit in all the departments of the Navy. Otherwiſe ſurely the Admiralty would order frigates experimentally built, with their ribs horizontal, lined with the broadeſt timber, forming inverted archwork. An unneceſſary conſumption of timber militates againſt population and the poor, as the more woodlands exiſting the leſs paſture and arable. The Americans, in ſpite of their immenſe woods, have begun the practice. If European Powers imitate them, and the plan remains neglected by Great Britain and Ireland, we ſhall be ruined as a Naval and Commercial Power.

Upright Clarence ariſe! and let the Navy of England have royal ribs horizontal like your own.

A FRIEND TO NAVAL ARCHITECTURE.

No. VI.

To the PRINTER *of the* PUBLIC ADVERTISER.

SIR,

HAVING met with the following preſcriptions in a little work which treats of the means of preſerving the health of Seamen, in cold, wet, and moiſt weather, I thought they might be uſeful to perſons on ſhore in the ſame circumſtances: However, that I might not venture to preſcribe without ſome authority to warrant me, I conſulted my apothecary, who told me he could ſee nothing amiſs in either, or that was not proper, and likely enough to anſwer what was intended by them. And ſo, Sir, I requeſt of you to give them ſtanding room in your Paper, for the benefit of Milk-people, Watchmen, and others, who are obliged to be out all night, or very early in the morning, in bad weather as well as good.

The firſt of theſe, is to take a baſon of good ſaſſafras tea, with a dry or buttered toaſt, as they like, or are able, juſt before going out, by way of breakfaſt, and at going into the air a few juniper berries, ſix or ſeven, if large; eight or ten, if middle-ſized, or a dozen of ſmall; or elſe a bit of garlick, or a bit of raw onion, bruiſing them a little with the teeth, and keeping them in the mouth like a quid of tobacco, and ſwallowing the juice by little and little afterwards.

The other is a kind of laced flip, and is thus made: Of good ſmall-beer, one pint; brandy one quartern; cream of tartar, one drachm; molaſſes, treacle, or coarſe moiſt ſugar, enough to make it palatable. An allowance of a can of this was much recommended to Government in cold, rainy, and blowing weather, to enable the men to ſupport the fatigue of the hard duty they then had to do, as well as for a defenſative againſt the ill impreſſions of ſuch weather; and no doubt would be equally beneficial to landmen on like occaſions.

Could our poor and labouring people be perſuaded to make trial of theſe, and ſuch like preſervatives, they would ſoon find the great advantage of it over that of ſpirituous liquors, a practice ſo univerſal, and yet ſo pernicious and deſtructive, that it would be a very hard taſk for any man to give a full deſcription of all the miſchief that is done by them: the beſt that I can think of is, that dry drams are the bane of the living and the dead, and even of thoſe who are yet unborn; and well would that man deſerve a ſtatue and a penſion, who could ſuppreſs the practice, either by perſuaſion, or any ſalutary reſtrictive law.

It may be objected that brandy is too dear for ſuch kind of people; it is true it is dear, and dearer, I think, than it ſhould be; but ſomething of a remedy may be found for this viz. Let there be three-fourths of a pint of ſmall-beer, a drachm of cream of tartar, and half a quartern of brandy; I have tried this, and am of opinion it would be ſtrong enough:—however, old, dry gin, though not altogether ſo good as brandy, would not be a bad ſubſtitute, and then there would be very nearly a pint of a pleaſant wholeſome beverage, at much about the price of a pint of porter; this is to be ſweetened with molaſſes, or coarſe moiſt ſugar, to every one's palate.

And now I am upon ſuch a ſubject, I would recommend a caution to be uſed by people who have been long out in cold, rainy, or froſty weather, and are greatly chilled, ſo as, in the common phraſe, to be dead with cold, or froze to death; and that is, not to come too ſuddenly to the fire, or to take a dram, but wrap themſelves very warm, firſt changing their cloaths, if wet, and then drinking a baſon of warm ſage tea, or ſaſſafras, if they have any made, or elſe of common tea; after which, in a quarter of an hour, they may take a ſmall dram, diluted with about one-fifth part of water, if they have it; garlick brandy is the beſt dram upon ſuch an occaſion: next to that cherry brandy, and to rub the hands and legs with a flannel, and ſo bring them to by degrees. This is far better than to come all at once to the fire, or to ſwallow a dram, both of which have been known to produce very bad effects.

A Friend to Society; and the Induſtrious
and Labouring Part of it in particular.

No. VII.

To the EDITOR of the EUROPEAN MAGAZINE.

SIR, *Redbridge, March* 6, 1792.

I AM very much obliged to you for your kind letter of the 1ſt inſtant and the incloſed papers, and am greatly flattered by what the Monthly Reviews ſay of my Pamphlet. You ſay, that laſt month you wrote a letter and encloſed the two prints of *Flora Ruſtica* done under the inſpection of *Profeſſor Martyn,* which I never received, but ſhall be much obliged to you for them. I have taken the liberty of ſending you a Drawing of an Inſtrument which I have contrived for Planting of Acorns in Buſhes of all kinds. It is found by experience, that buſhes of white and black thorns, holly, and brambles, are the beſt nurſes and protectors of young timber-trees, particularly on open or uninclosed lands, ſuch as lanes, commons, hedge-rows, and foreſt lands; for wherever there is a ſtock of buſhes on ſuch lands they ſeldom fail to bring forward ſooner or later timber-trees in abundance of ſome kind or other, if the ſoil is friendly and proper for the growth of trees; yet the planting of their ſeeds muſt be accidental and very uncertain, as it is only by the birds or ſome caſual means that they are dropped by chance, and not one of a great many may happen to reach the ground ſo as to ſtrike and produce a plant; of courſe, it may be many years before any number of plants are brought forth by this means, and I have ſeen large tracts of land nearly covered with underwood and buſhes with very few timber plants among them. But by the uſe of this Inſtrument, the ſeeds of timber-trees may be planted in any buſh effectually and with the greateſt eaſe and expedition, eſpecially acorns, which it is more immediately calculated to do; and buſhes are the fitteſt places to plant them in, and ſhould never be omitted when the opportunity offers, as the oak requires a guard and defence in its infancy. I have this ſeaſon planted a great many acorns with the Inſtrument, and flatter myſelf, could the uſe of it be made general, that moſt of the buſhes in the kingdom on uninclosed lands would ſoon be filled with oak plants, to the great benefit of many individuals, and in time be productive of much public utility: with this view I intend ſending one of the Inſtruments to the Society for the Encouragement of Arts and Sciences in London, and another to the Bath Society. I have ſhowed it to many gentlemen in this neighbourhood, who have been much pleaſed with it, and I have got ſeveral of them made; ſo I hope by degrees to get them into common uſe.

The following are obſervations on the nature of the ſap of oak-trees, ſhould you think them worthy of being communicated to the public, you will be ſo good as to convey them through the channel of ſome of your Publications.

It is to be obſerved, that oak trees increaſe in their diameters by repetitions of coats of new wood annually formed between the bark and the coat which was formed the year preceding: at firſt this new wood is imperfect and is called ſap, and trees generally contain from fifteen to thirty of theſe ſappy coats, and occupy a ſpace from about half an inch to four inches in thickneſs taken together, according to the ſlow or quick growth of the trees, and I have found by experiments that theſe ſappy coats are nearly of the ſame weight and texture throughout in the ſame tree. It clearly appears to me, as a tree puts on only one coat a year, only one coat a year is transformed from ſap to heart or perfect wood; ſo that it is from fifteen to thirty years after the firſt formation of theſe coats before they are brought into perfect wood; but they are not gradually brought into this ſtate, if they were, they would be of different weights and textures, which they are not, but are ſuddenly changed (once a year) from ſap to heart. It alſo appears that in trees, however old, they retain the ſame number of ſappy coats as they did when young and vigorous, though gradually occupying leſs ſpace as the trees advance to maturity, as they proportionably decreaſe in growth; but ſtill continue to put on their annual coats, however ſmall, ſo long as they grow at all.

I received from Mr. *Adams*, of *Bucklerſhard*, part of an oak which was ſtripped of its bark ſtanding in Beaulieu manor in the ſpring of 1784, and felled in the ſpring of 1788. The tree appears by the number of its annual coats to have been 110 years old at the time of its being ſtripped; it contains twenty-one coats of ſap, which are in a periſhing ſtate; ſo that the notion which ſome have entertained, that the ſappy parts of oak-trees become as hard or equal to the heart for ſtrength and durability, by the operation of ſtripping them ſtanding of their bark, and letting them remain till they die before they are felled, is chimerical, as is clearly proved by this experiment. If no other information had been collected from it, there was no compariſon to be made between the ſtrength and denſity of the wood of this tree and others of the ſame age and ſize, which might have been felled at the time this was ſtripped, near where it ſtood, or others ſtripped of their bark and felled at the time this was.

The Count De Buffon has inconteſtably proved by his experiments, that by ſtripping oak-trees of their bark ſtanding, and letting them remain till they die before they are felled, the heart or perfect wood thereof will be conſiderably increaſed in ſtrength and denſity; and it is alſo proved by experience, that the ſappy part or imperfect wood will not be much altered thereby at firſt, and while it is green it will be found harder and ſtronger than the ſap of trees felled in the uſual way; but after a little time, and as the juices evaporate and fly off, it will periſh and moulder away, as the ſap of oak-trees will always do, let them be treated in whatever manner they may with a view to prevent it. Every experienced ſhip-builder or carpenter well knows, that wherever any ſap is worked with the heart of oak (as it ſometimes is), it will ultimately tend to weaken and injure the building wherein it is uſed; for, however fair and well it may appear at firſt, it will moſt aſſuredly decay in a ſhort time.

For want of examining the original thickneſs of the ſap of oak-trees and the progreſs of its decay, and from finding ſo much of young trees waſted by the decaying of their ſappy coats, which generally occupy a conſiderable ſpace, particularly if the trees were very vigorous at the time of their being felled, ſome have been led to imagine, that by trees laying for any length of time, the ſap increaſes in its thickneſs, or that part of the heart is transformed into ſap again, which is by no means the fact; for if any part of the heart were ſubject to ſuch change by laying, there can be no good reaſon aſſigned why in the proceſs of time the whole ſhould not undergo the like change; which is abſurd, and contradicted by experience; for after the ſappy coats are once formed into perfect wood, it ever remains in that ſtate till it naturally decays.

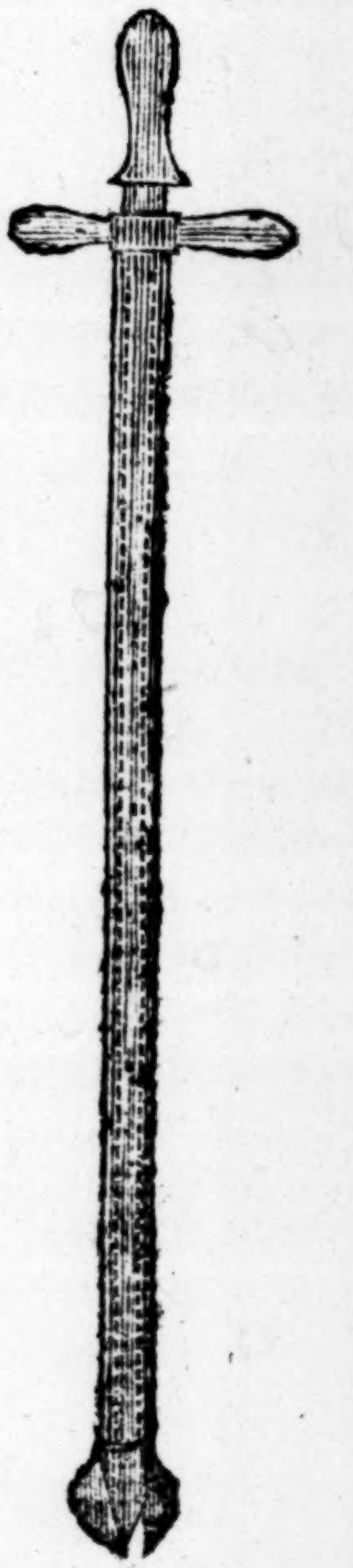
A REFE-

A REFERENCE *to* PIECES *of* OAK *numbered* 1, 2, 3, 4, 5, 6, 7, 8, 9, *taken from ſeveral Trees, in order to point out the great Variety there is in the Thickneſſes of Sap, and the different Number of annual Coats of which it is compoſed according to the quick or ſlow Growth of Trees.*

REMARKS.	Number of the piece.	Thickneſs of the ſap in inches and parts.	Number of annual coats.
Taken from a tree which was ſtripped of its bark ſtanding in the ſpring of 1784, and felled in the ſpring of 1788. The tree appears by its annual coats to have been 110 years old when it was ſtripped,	1	$1\frac{1}{8}$	21
The ſap is in a periſhing ſtate,	2	$2\frac{7}{8}$	27
	3	$2\frac{3}{8}$	18
	4	$1\frac{3}{4}$	16
	5	$\frac{3}{4}$	24
	6	3	20
The growth extremely ſlow,	7	$\frac{1}{2}$	30
The ſection of a ſmall oak 13 years old all ſap,	8	$1\frac{7}{8}$	13
This tree by its annual coats was 73 years old when it was felled,	9	$3\frac{3}{4}$	29

I am, Sir, with reſpect, your moſt humble Servant,
THOMAS NICHOLS.

THE DRAWING OF AN INSTRUMENT*, by a SCALE of $\frac{82}{100}$ of an INCH to the FOOT, for PLANTING of ACORNS in BUSHES of all KINDS.



THE way of uſing the Inſtrument is as follows: Firſt, put it through the buſh into the earth, and work it about till there is a bed made fit for the reception of the acorn (which is very ſoon done); then draw it back to the ſurface; take out the rod, and put the acorn into the tube, and immediately follow it with the rod, which will place it about two inches in the ground; then move about the inſtrument at the ſame time, gently preſſing down the earth with it, and the acorn will be ſecurely planted.

* One of theſe Inſtruments (five feet four inches in length—ſix inches in circumference in the whole—and three inches in circumference in the bore) may be ſeen at the European Magazine Warehouſe, No. 32, Cornhill; and where any Gentleman, deſirous of having one, may be informed where he can purchaſe it ready-made.

No. VIII.

To Mr. SEWELL.

SIR, *Redbridge, May* 22, 1792.

PRESUMING that in the preſent condition of this country with reſpect to the growth of timber, the raiſing of oak for the ſupport of our Navy and Commerce will naturally be the firſt object of attention to the departments more immediately charged with thoſe important concerns—I humbly conceive that the judicious management and converſion of ſuch timber, in the view of preſerving and applying it ſo as to obviate all unneceſſary waſte and decay, will be as naturally the ſecond object of their regard.

Theſe purpoſes I may venture to ſay can in no way be ſo effectually accompliſhed, as by bringing the timber in a rough hewed ſtate to the building-yards wherein it is to be uſed.—The greater the choice of rough timber in ſuch yards, and the more it is ſpread about, ſo as the different forms and ſizes may be ſeen and eaſily got at, and the greater variety of ſhips of different magnitudes on which it may be uſed, the greater will be the profit reſulting from a ſkilful application of each piece to the greateſt advantage; always remembering that ſuch application can be expected only from men of ſound judgment and long experience.

Every Builder with whom I have converſed on this ſubject, has without heſitation teſtified an abſolute preference of the rough hewed to any other form; and with exception of a very few inſtances, this has been the form in which all the private Builders, during the laſt war, have choſen to purchaſe their timber, and have it ſent to their yards for building ſhips on Government's account. Had it been more advantageous to ſide or convert the timber at the places where it grew, it cannot be eaſily conceived that perſons of ſo much experience would have neglected that method, to the injury both of their fortunes and reputation.

I am aware of all that has been ſuggeſted by the advocates for ſiding and moulding timber in the woods for ſhip-building; and after allowing to their arguments the utmoſt force which they will bear, I am not afraid to affirm that their ſyſtem is not reducible to practice, with benefit to the public. The conſiderable practice which I have had in travelling to collect timber for naval uſes, emboldens me to appeal to the experience of all thoſe who have been employed in the ſame buſineſs, and indeed to the common ſenſe of every one who will be at the trouble of conſidering for a moment the great variety of forms and ſizes to be ſelected in different and diſtant parts of the country, and the vaſt quantity which muſt be ſurveyed, before a ſingle ſhip's frame can be obtained in the preſent timbered ſtate of the kingdom, to ſay nothing of beams, plank, thick ſtuff, and knees.

It muſt alſo be remembered, that except three or four timbers, every other one in a ſhip requires a different mould, and is of a different bevelling, and that every claſs of ſhips muſt have a ſeparate and diſtinct ſet of moulds.

Without going any further into this ſubject at preſent, I would humbly aſk the gentlemen who propoſe timber to be converted to the various purpoſes of ſhip-building in the country near where it grows in the different parts of the kingdom, and afterwards to be ſent to the dock-yards exactly fit to be put into the ſhips for which it was deſigned, how, under the circumſtances before mentioned, it is poſſible to be done with advantage to the public?

The only thing, in my opinion, which can be done to timber applicable to naval uſes, with any ſort of propriety, when it lays at very great diſtances from the dock-yards, and the expence of the carriage of it in a rough ſtate would be very great, is, to ſide and cut it off nearly to the lengths to which its natural growth points it out to be moſt applicable in ſhip-building; and this ſhould be done with the greateſt caution and judgment, and by people who are not at all intereſted about the forms or ſiding of it; for I have known a great deal of timber much injured in its converſion by cutting it off to improper lengths, and giving it that form by hewing, which nature had never given it, on account of its yielding higher prices when ſent to the dock-yards: and I believe, on the whole, it will be found that no timber in the end comes ſo expenſive as that which is ſided in the country on Government's account.

I preſume it is of much conſequence to know with certainty, whether oak-timber receives injury or is benefited by being laid up in piles, rough hewed in the ſap, as it is at the dock-yards, and remaining ſo till it is converted for immediate uſe, whether for two, three, four, five, or ſix years, as it ſometimes does.

As experience is the beſt teſt for grounding our obſervations on, we therefore ſhould always avail ourſelves of it whenever it offers for our guide.

And it happens very fortunately, that by long experience it is unequivocally proved, that the beſt way hitherto known of keeping or ſeaſoning of oak timber previous to its being uſed in Ship-building, is in a rough-hewed ſtate, with its ſap on; not only on account of applying it, when wanted, to the moſt profitable uſes, but by lying in the ſap for two, three, or more years, it ſeaſons gradually, and never ſplits or opens, as it frequently does when the ſap is taken off, by ſiding or converting it when green, and laying it in piles, and whereby it frequently receives very conſiderable damage, and very often is entirely ſpoiled. This is never the caſe, if it be ſuffered to ſeaſon in the ſap: for though the ſap is certain to periſh, and moulder away in a few years, let it be treated in whatever manner it may, with a view to prevent its periſhing, ſtill the heart will be greatly improved by this mode of treatment, and, I believe, will endure many years the longer for it; and certainly when it is converted, it will have the great advantage of not twiſting and flying about, as when worked green.

As it is an eſtabliſhed fact, that timber by ſeaſoning in the ſap is greatly improved, and is never known to receive injury thereby, it will follow of courſe, that there ought to be a large ſtock kept in that ſtate in the dock-yards. It was very judiciouſly ordered by the Navy-board ſome years ago, that there ſhould always be a ſtock kept equal to three years conſumption.

It may alſo be of ſome uſe to enquire, whether oak timber is generally injured or benefited by being cut in lengths and ſided ſoon after it is felled and ſent to the dock-yards, and there laid up in piles till it is wanted for immediate uſe. We find by experience that after it has laid ſome time in this ſtate, a great deal of it turns out very defective and rotten, particularly at the heart; a circumſtance for which I can aſſign no other cauſe than by this mode of treatment. The annual coats of wood, of which trees are compoſed, and which encompaſs them like hoops, and hold them together, are in part cut off, and the juices flying off very quick frequently cauſe them to ſplit, or crack, and the cracks or fiſſures receive the wet, which ſoon brings on rottenneſs. And though theſe cracks may not always happen, yet by diveſting the trees (before they are ſeaſoned) of their ſappy coats, the exterior parts of the wood or heart, by expoſure to the air, ſuddenly contract, and ſhut up their pores, ſo as to prevent the eſcape of the internal juices: hence a fermentation ſoon begins, and rottenneſs is ſtill the certain conſequence. This does not happen when timber is ſeaſoned with its ſap on; the outward parts of the wood not being then ſuddenly contracted, on account of being ſheltered from the ſun and wind by the coats of ſap which ſurround it, and the juices evaporating freely through the ſpungy ſubſtance of the ſap.

Add to this, the great evil which ariſes from the perverted converſion which the timber undergoes in the country, in order to make it bring the greateſt price.

From the facts here ſtated it muſt appear evident, how neceſſary it is to have as much timber as poſſible delivered to the dock-yards in a rough ſtate, and to remain ſo till it is wanted for immediate uſe.

On account of the heavy expence attending the carriage of timber from the interior and diſtant parts of the country to the dock-yards in a rough ſtate, and from the neceſſity of a ſupply for the demands of the navy, which ſupply cannot be obtained but by having recourſe to thoſe parts, I fear it will be always found requiſite to have it in a ſided ſtate; a meaſure I conceive to be wiſe and prudent, as it will operate as the means of encouraging the growth of oak timber in the inland and remote parts of the kingdom.—But I would humbly propoſe, that every temptation ſhould be removed from the merchants that induces them to violate the natural growth of the timber by a forced converſion; which I judge may be eaſily effected by putting the prices in the ſided contract entirely aſide, and paying for the timber according to its metings, as is done for rough timber, without having any regard to the forms of it, except to thoſe of compaſs and ſtraight.—Indeed the merchants ſell it one to another all at one price per foot, whether it be large or ſmall, without any diſtinction of form or ſidings. And I would propoſe that the lengths and ſidings be marked by the purveyors, on their ſurveys, and an account thereof inſerted in their Reports.—And the timber, after being received at the dock-yards, ſhould be put in claſſes, and kept in ſalt water till it ſhould be wanted for immediate uſe, as is the practice in Holland and Spain. This, I believe, would be the means of preſerving it ſound and good for any length of time, as timber was never known to decay while it has been ſo kept: or perhaps the burying it in ſand might anſwer all the deſired purpoſes; for, regarding the ſand as an artificial ſap, the timber would thereby be ſheltered from wind and ſun, and prevented ſplitting or cracking, and the juices would evaporate freely through it, and thereby become well ſeaſoned. Mr. Townſend, in his Journey through Spain, ſays, that at Cadiz, to preſerve their ſtore-maſts from the worms, from the wind, and from the ſun, they are buried in ſand, and by this ſimple method are preſerved many years.

As the foregoing obſervations are the reſult of long experience, and made with no other view than that of promoting public good; I hope that they will not be thought altogether undeſerving ſome attention. —And in corroboration of what I have advanced, I have the ſatisfaction to ſubjoin the opinions of ſome profeſſional men, whoſe experience and judgment on this ſubject cannot be doubted.

Wedneſday, June 15, 1791.

I WAITED on Mr. *John Nowland*, Ship-builder at Northam, who has built ſix frigates for Government, and aſked him ſome queſtions relative to the moulding of timber in the woods for ſhip-building, and ſeaſoning of it previous to its being uſed in ſhips. He ſaid, that he ſhould always chuſe that timber ſhould be brought to his yard only rough-hewed, as in that ſtate the utmoſt advantage could be taken in converting of it to the beſt advantage, and to the purpoſes to which it was moſt applicable, which could not be done in the woods, nor could he ſee how it could be done at all anywhere but at the building-places.

And he was of opinion, that the beſt way of ſeaſoning timber before it was converted for immediate uſe, was letting it remain rough in the ſap; and further remarked, that he once purchaſed upwards of 300 pounds worth of ſided timber of Mr. *Hounſom*, which had all the appearance of being ſound and good, and every way fit for his purpoſe; but when it came to be moulded, it proved ſo defective, that he uſed only five pieces of it in the frigates he was then building.

Friday, July 17, 1791.

HAD a converſation with Mr. *David Smith*, one of the Converters of timber at the ſaw-pits in the dock-yard at Portſmouth, who has been in that ſtation 23 years; and he was clearly of opinion, that the practice of bringing oak timber to the yard in a rough ſtate, laying it in piles, in the manner uſed at Portſmouth-yard, and ſuffering it to remain ſo until it is wanted for immediate uſe, is the beſt way of ſeaſoning and keeping timber before it is uſed in ſhip-building:

That he has found in the courſe of his practice, that timber which had been ſo laid up, though for many years, has, when converted, proved ſound and good, and, he thought, much benefited thereby: that among timber which has been ſent to the yard in a ſided ſtate, and laid up in piles for any length of time, he has found a great deal of it decayed, particularly at the heart: and, that if the ſided timber were kept in ſalt water till it was wanted to be converted for immediate uſe, it would be preſerved ſound and good. In confirmation of this opinion, he remembers that about 22 years ago, when Mr. *Bucknald* was Builder at Portſmouth-yard, he was at the taking up of ſome pieces of oak timber out of the mud and water in the boat-houſe pound, which had been converted for ſtem and keels on pieces; and they were all as ſound and good as could be: they were laid down again in the ſame place, and were finally taken up about ſix or ſeven years ago, and turned out, upon the ſecond converſion, as ſound and as good as timber could be, and he imagined that from firſt to laſt they muſt have laid in the mud and water more than 40 years.

He was further of opinion, that it would be greatly to the intereſt of Government to have all timber ſent to the yard in a rough ſtate, whereby the beſt and moſt profitable converſion might be had; a benefit which cannot be obtained while the timber is ſided, and cut to lengths in the country.

Mr. *Robert Gilbert*, the other Converter of timber, whom I converſed with the ſame day, but ſeparately from *Smith*, and who has been in that ſtation 27 years, was in every reſpect of the ſame opinion with *Smith*, and declared that he never found any piece of timber injured by lying in piles in a rough ſtate, but, on the contrary, always improved, by being ſeaſoned, as he thought, in the beſt way poſſible.

The ſame day I converſed with Mr. *White* the Builder of Portſmouth-yard, Mr. *Tippett* his firſt aſſiſtant, Mr. *Trefry* the ſecond aſſiſtant, and Mr. *Howell* the foreman of the ſhipwrights, on this ſubject; and they were all of the ſame opinion with *Smith* and *Gilbert*.

Saturday, July 25, 1791.

I CALLED on Mr. *Adams* the Ship-builder at Buckler's-Hard, who I believe has built more men of war for Government than any other private Builder in the kingdom.

I aſked him ſome queſtions concerning the mould of timber in the woods, in the different parts of the country, for the ſeveral purpoſes of ſhip-building. He ſaid, that it was impoſſible to be done (it is to be obſerved that Mr. *Adams* is allowed to have been one of the beſt Converters of timber in the trade); and that he always wiſhed to have his timber brought to his yard rough hewed, as in that ſtate he could take every advantage in converting it to the beſt and moſt profitable uſes; and on this account, he ever had it brought rough to Bucklers-Hard, though frequently from great diſtances by land, at a very heavy expence. He once by neceſſity had ſome ſided timber brought from

Herefordſhire; but never deſired to have any more if he could procure it rough. He further ſaid, that he never had found timber to receive injury by lying rough in the ſap; and there is now a great quantity which has been in his yard many years in that ſtate, the ſap of which is entirely periſhed, but the ſpine or heart is ſound, hard, and good, and has, I believe, improved by ſo lying.

Friday, the 22d *July* 1791.

RECEIVED of Mr. *Parſons*, the ſhip-builder at Burſledon, an account of the ſhips which he had built for Government, ſix in all, two of which were of the line of battle. He at the ſame time told me, that every man who knew any thing of ſhip-building, muſt always wiſh to have his timber for that purpoſe ſent to him in a rough ſtate: he never had it any other way.

Saturday, the 8th *October* 1791.

I ASKED Mr. *Rule*, the Builder of Woolwich dock-yard, in what ſtate he would prefer timber for ſhip-building brought to the yard. He was rather ſurprized at the queſtion, and ſaid, that every man who knew any-thing of the ſubject muſt prefer it in a rough ſtate; and he was certain that the beſt way of keeping timber before it was converted for immediate uſe was rough in the ſap, as by that mode of treatment it ſeaſoned gradually, and never ſuſtained any damage thereby; whereas that which is laid up ſided, or converted, frequently turns out very defective.

Mr. *Poore*, Timber-merchant at Redbridge, has a great quantity of timber, which has laid in his yard on the ground many years, only rough hewed, the ſap of which is entirely periſhed, but the heart is ſound and good, and much improved by lying, it being thereby extremely well ſeaſoned; and he has built many veſſels from timber of this deſcription, particularly a fine ſhip for the South Sea trade; and there is every reaſon to believe that they will endure a great deal longer than veſſels built with timber not ſo ſeaſoned.

I was witneſs the other day to the converſion of a piece of timber into a beam which had laid in Mr. *Poore*'s yard on the ground 24 years, which had been rough hewed: the ſap of it was quite decayed, but the heart was as ſound and good as could be. If it was neceſſary, I could bring a thouſand inſtances to prove that oak timber is never injured by lying to ſeaſon in its ſap, but on the contrary greatly improved thereby.

A few years ago, a 50 gun ſhip, which was to be called the Leopard, was ordered to be laid down in Portſmouth-yard, which was done, and her frame collected, ſided, and moulded, and laid together for ſome time, and ſticks put between the timbers in order to keep them ſeparate, and for the air to act on them; after this, the ſhip was ordered to be built at Sheerneſs, and when the timbers came to be examined, about one-third of them proved defective. I only mention this circumſtance as a confirmation of the ill effects ariſing from converting of timber and laying of it together in piles, though ſeparated as before obſerved.

Notwithſtanding the foregoing obſervations on the converting and ſeaſoning of timber are built on the firm rock of experience, I find they are flatly contradicted, through the channel of a very laborious and reſpectable publication (the Eleventh Report of the Commiſſioners of the Land Revenue) by Mr. *Snodgraſs*, Surveyor of the Eaſt India Company's ſhipping. Had Mr. *Snodgraſs* well conſidered the nature of laying ſhips down, moulding of their frames, and how timber is obliged to be gleaned from vaſt quantities in different parts of the country for building large ſhips, I think he never could have replied as he has in his Anſwer to the Commiſſioners 21ſt Queſtion, That the moulding of timber for the various purpoſes of ſhip-building may be done at or near the places where it grows to great advantage; and in his Anſwer to their 22d Queſtion, more eſpecially if converted by Contractors? Had ſuch a mode been practicable with advantage, is it not ſurprizing that it was not put in execution by the Contractors who built ſo many ſhips for Government during the late war? And if ſo, why is it not now done by the Builders of the Indiamen? The reaſon is obvious to every man who is well acquainted with ſhip-building, and has travelled to collect timber for that purpoſe—Becauſe it is not to be done with advantage: and in the preſent timbered ſtate of the kingdom, I cannot ſee how it can be done at all, when it is conſidered how large timber lies ſcattered over the country, and that in almoſt every parcel which is ſurveyed, pieces of various forms and ſizes are found fitting for ſhips of different claſſes, from a ſloop to a firſt-rate. Under theſe circumſtances, I cannot conceive how timber can be manufactured in the places near where it grows, to the ſeveral uſes in ſhip-building to which it is moſt applicable.

Again, had Mr. *Snodgraſs* given himſelf the trouble to have examined the real ſtate of the timber which is laid up in piles in a rough ſtate in the dock-yards, and the effects which are produced thereby; it would have been impoſſible for him to have caſt ſuch an unjuſt and groundleſs cenſure on the officers of the dock-yards, nor have dared to have made to the Public ſo falſe a declaration as he has done in his Anſwer to the Commiſſioners 20th Queſtion, by ſaying, that one-third or more of the timber which is ſo laid up is rendered thereby unfit for ſhip-building. Had he took the neceſſary pains, as he ought, to have examined into this matter, before he had made this declaration to the Public, which at leaſt would have been candid, and what every perſon whoſe object had been the truth, would have done;—he then would have found that the exact contrary had been the fact, and that ſo far from timber receiving injury, and being rendered unfit for ſhip-building by being ſo laid up, it is much improved thereby, by being ſeaſoned in the beſt way hitherto known, before it is uſed in ſhips, and never known to be anyways damaged by lying in that ſtate: and I challenge Mr. *Snodgraſs* to prove one ſingle inſtance to the contrary. But it ſeems, according to this gentleman, that every thing which is done in a dock-yard muſt carry with it the marks of peculation and ignorance.—I am, Sir,

With reſpect,

Your moſt humble ſervant,

T 2 THOS. NICHOLLS.

No. IX.

NAVAL QUESTION.

To the PRINTER.

SIR,

THE following Queſtion is reſpectfully propoſed to the SOCIETY of the laudable Inſtitution of NAVAL ARCHITECTURE; or any other ingenious perſon.

"What is the Specifick Gravity of a Seventy-four Gun Ship, or any other?" immediately after launching, or any time afterwards, is not material.

The Propoſer obſerves, in order to aſſiſt the enquiry, that whatever ſpace the Ship occupies, the ſame bulk of water will be the ſpecifick weight of the Ship—therefore the whole difficulty lies in finding the preciſe quantity of water ſuch a formation of body will occupy—or in other words, of reducing the extreme capacity of the Ship's body from the water-line downwards into cubical feet, &c. a piece of knowledge at preſent but little underſtood, therefore deſerving the attention of the curious, if not the notice of the Hon. the Navy Board, where ſuch knowledge ought to be recorded.

The line of bearing muſt firſt be attended to, and ſo gradually downward according to the conſtruction of the ſhip's body.

A ſolution of this intricate queſtion may be attended with many advantages. MEM. The ſpecifick gravity of a cubical foot of ſalt-water is about 72lb.

Hampſhire, April 4. P. E.

No. X.

ANSWER *to the* NAVAL QUESTION *propoſed by* P. E.

Firſt Part of the Queſtion.

WHAT is the ſpecific gravity of a ſeventy-four gun ſhip, or any other? immediately after launching, &c.

Anſwer—There are not ſix ſhips in the Navy of any one claſs built upon the ſame plan, therefore ſhips of the ſame claſs muſt vary in their tonnage.

Second Part of the Queſtion.—The propoſer obſerves, in order to aſſiſt the enquiry, that whatever ſpace the ſhip occupies, the ſame bulk of water will be the ſpecific weight of the ſhip; therefore the whole difficulty lies in finding the preciſe quantity of water ſuch a formation of body will occupy—or in other words, of reducing the extreme capacity of the ſhip's body from the water line downwards, into cubical feet.

Anſwer—There is but one method of aſcertaining with certainty the tonnage of a ſhip or veſſel. Let any common dock be filled up ſo as to make it an exact parallelopiped—let a ſcale of feet and inches be placed vertically in it—the ſolid contents of the Dock and the weight of the water it contains at any given height will be known when the Dock-gates are ſhut—let off that water into a baſon or reſervoir—then let water into the Dock, and take a ſhip or veſſel into it in a light ſtate, and afterwards let the water out of the Dock by the falling of the tide, and ſhut the Dock-Gates—then fill the Dock up by pumping the water into it from the baſon—the riſe of the water in the Dock, higher than it was originally, is the weight of the ſhip or veſſel in a light ſtate—load the ſhip or veſſel to her load-water-line—this additional riſe of the water in the Dock is equal to the internal capacity of the ſhip or veſſel, which is her tonnage.

QUÆRE.—Suppoſe two veſſels ſimilar, but built of different woods whoſe ſpecific gravities are unequal—their admeaſurement is the ſame, though the columns of diſplaced water will be different both in a light and in a laden ſtate.—Is their tonnage the ſame, if their reſpective weights differ and draughts of water alſo?

No. XI.

To the PRINTER.

SIR,

THE Propoſer of the Naval Queſtion cannot but approve of the mode pointed out for aſcertaining the ſpecific gravities of the bodies of veſſels, as no other can be ſtrictly true, conſidering the different materials, and the variety of curvatures ſuch bodies conſiſt of. However, there appears a little overſight in the proceſs, as I fear no reſervoir can at preſent be found in any of the King's yards deep enough to drain the water from any neighbouring dock for the purpoſe intended; therefore I conceive the words "pump out," ſubſtituted for "let out," will be an amendment neceſſary to perfect the way recommended for a true Anſwer to the Queſtion: for admitting a reſervoir was near enough, and capable of draining off the water, I can hardly think the ſame within the reach of common pumps to return, whoſe action by the effects of the atmoſphere is too confined to admit of it. But that does not affect the principle on which the Anſwer is founded, for that will remain invariably the ſame ſo long as fluids retain their reſpective laws and properties aſſigned them.

As the hydroſtatic principle is therefore the moſt applicable for aſcertaining the ſpecific gravities of bodies, whether ſolid or otherwiſe, however irregular, I beg leave to ſuggeſt, whether inſtead of a dock fitted up in the parallelopipedon form (a figure very appoſite for the purpoſe), a floating machine, with gates at one end, conſtructed in the ſame geometrical manner, or rather the parallelogram with the addition of a triangle to two of its ſides and its foremoſt end, giving it the appearance of a large monſtrous barge, would not have the preference. Before opening the gates to receive the ſhip, you have only to remark its draught of water in a light ſtate, and after the reception of her, and pumping out the water it contains, to repeat your obſervation; the difference between the two ſtates will be the anſwer required. Were ſuch an aquatic engine conſtructed, any ſhip, light or laden, may be weighed at pleaſure, beſides the convenience of doing any neceſſary repair to her bottom, if required, ſo as in every reſpect to anſwer the purpoſe of a floating repairing dock, or an exact aquatic weighing machine.

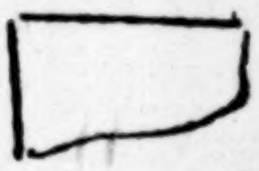
But as it is moſt probable that neither of the above ſchemes will ever be put into execution to inveſtigate the Queſtion propoſed, the Public will ſtill continue ignorant of forming any adequate idea reſpecting the weight of ſhips; whereas were the plan adopted only for a few years, I will venture to ſay, from the frequency of the experiment, ſuch a habit would be contracted by thoſe whoſe province it ſhould happen to fall upon to attend to it, as to be able, without its aſſiſtance, to form a tolerable good judgment of the gravity of ſhips bodies whenever required: and although ſuch judgment or opinion, from the manner of its being formed, cannot be otherwiſe conſidered than as very erroneous, I may venture to pronounce it, notwithſtanding, ſufficient to put us in poſſeſſion of more knowledge on the ſubject than any one can at preſent pretend to.

Loſing ſight, therefore, of all hope of arriving to the knowledge ſought for, viz. the ſpecific gravity of a ſeventy-four-gun ſhip (by the ingenious and only true way propoſed by the Gentleman who honoured the Queſtion with an Anſwer), for various reaſons I am driven to the neceſſity of requeſting a ſolution in ſome other way—if poſſible, I could wiſh to ſee it geometrically conſidered inſtead of hydroſtatically. I am aware of the difficulty of ſuch an undertaking; but if an individual could compaſs that in his cloſet which in the former inſtance muſt be the efforts of many, beſides being attended with a heavy expence, it would be laudable in any one to attempt it, and honourable to him who ſhould have ingenuity, fortitude, and perſeverance enough to accompliſh it. And although a ſolution in that way, if practicable even within a reaſonable degree of truth, muſt be attended with almoſt infinite difficulty and labour, yet it muſt be allowed it can never give the ſatisfaction (I mean as to the true ſpecific gravity of a ſhip's body) as the former one:—her capacity may perhaps with difficulty be reduced into cubical meaſure, but her real ſpecific weight cannot by any geometrical means or calculation be known, ſo long as one material ſhall differ from another in gravity.

But placing the ſpecific difference of materials which different ſhips are built with out of the queſtion, it would be a great acquiſition to the Public to ſee a ſolution in the manner now propoſed, with all its defects, as it is not likely to be done in the other; for the preciſion of a pound is not expected, neither will the deficiency of a ton be of any great conſequence in bodies of ſuch magnitude. It would be fully ſatisfactory to the propoſer, as well as pleaſure, to ſee a queſtion ſo complex brought within ſome degree of certainty, eſtabliſhing a kind of data to help an enquiry in like caſes for the future, till Government, or ſome other reſpectable body of men, ſhall be pleaſed to give the world a more perfect account, by adopting, as recommended, the only true method of finding it.

To attempt to point out a mode for accompliſhing ſo deſirable a piece of knowledge in the laſt way propoſed, may by ſome be conſidered as preſumptuous, or aiming at impoſſibilities—be that as it may —but when a well-meaning man is exerting his poor abilities in endeavouring to promote any uſeful enquiry, he will certainly ſtand excuſed (whatever miſtakes his zeal may lead him into) in the eyes of the more diſcerning, who are always readier to countenance than diſcourage any ſcheme formed with a good intention. Impreſſed with theſe hopes and the novelty of the undertaking, I will venture, with great deference to better heads, to explain, in the beſt manner I can, the conceptions I entertain of conſidering the Queſtion in the new way with ſome degree of ſucceſs. I therefore ſubmit to conſideration, Firſt, Whether the whole ſpace of the extreme capacity of the ſhip's body cannot be divided into cubical quarters of an inch? The reaſon for chuſing ſo ſmall a cube is to conform to her curving ſides as much as poſſible without gaining or loſing materially either way.—Secondly, Should the above propoſal be thought too laborious, in order to leſſen the work, take as many cubical feet and inches as you conveniently can out of the extreme capacity of the ſhip's body; what is left of the remaining ſpace to be ſought for, as before mentioned, by cubical quarters of an inch, which will find out, nearly as before, the true formation of her body, from whence alſo may be collected a tolerable computation of her weight.—Thirdly, To explain further my idea of the poſſibility of the plan propoſed, and to leſſen ſtill the calculation, take one half only of the ſhip's body, fore and aft, from a middle line to the extreme breadth on either ſide, and begin your calculation, in the manner above ſtated, from the water-line downwards: that being aſcertained, double the contents, and the ſum will amount nearly to the weight of the ſhip required.

As to the ſteps to be purſued for carrying the above ſcheme into practice, I think very little, if any thing, need be ſaid. The reducing the whole capacity of the ſhip's body into cubes ſufficiently points out what is neceſſary to be done and wanting; doubtleſs ſome ingenuity is requiſite to conduct the undertaking, as well as patience and fortitude to combat its many difficulties. However, to throw out a few more ſcattered hints by way of explanation, leſt my ideas may be thought viſionary, and the mode of the propoſition impracticable, which may poſſibly turn out to be the caſe, I will, nevertheleſs, venture, with great diffidence, to preſs the enquiry, with all its defects. Let a ſection, I mean one half of the body of a ſeventy-four, be correctly laid down, in perſpective or any more convenient form, on a large ſcale, by ſome eminent draughtſman in the naval line, ſo as to exhibit from a certain point of view her length and breadth, including only as many ribs as may be neceſſary to find the curving running form of her body lengthways, viz. fore and aft. This executed, and having previous knowledge of her draught of water, let the ſame be marked fore and aft on the frame of the ſhip: from the perpendicular or middle line draw an horizontal one at right angles, with the former leading from thence to the greateſt extreme breadth and height of the water-line; to which if I add the ſuppoſed form of the ſhip's body downwards, it will aſſume the following appearance.



This being executed nearly in the midſhips, the perpendicular line, which is the depth of the ſhip under the ſurface, may ſerve as a ſcale to graduate and regulate the number of piers or ranges of cubes requiſite to fill completely the whole extreme capacity of the ſhip, but of little uſe in any other reſpect, except being conſidered as a part of the ſhip's frame. Having advanced thus far, the water-line ranging fore and aft ſhould next be ſet off according to the form of the body, in an exact manner, from a ſtraight line, dividing the ſhip in two, from head to ſtern, on a pretty large ſcale, exhibiting an appearance ſomewhat like this . This done, the mode recommended will find the contents that occupy the firſt range of cubes—the ſecond to be aſcertained in like manner, by deſcribing another formation of the ſhip's body under the firſt water-line, by ſetts-off from the middle line, as before directed: and ſo on, one under another gradually, deſcending by quarter cubes, keeping conſtantly cloſe to the longitudinal ſweep (I may ſpeak improperly) or curving form of her body, till the whole is completed.

This conſtant repetition, I muſt obſerve, of deſcribing the form of the ſhip's body ſo gradually as it deſcends downward from a middle line, ſeems to be by far the moſt troubleſome and tedious taſk; but difficulties muſt and will yield to a perſevering mind. It is needleſs to mention here, that the ſum of the whole maſs of cubes will be nearly the weight ſought for. Should a very large ſcale be required, the mould-loft, a place uſually appropriated for the laying down the form of ſhips' bodies, will afford ample ſcope for ſuch an undertaking. A model of a ſhip's body may be found of great ſervice in this enquiry; but perhaps, after all, recourſe to ſome of the frames of his Majeſty's ſhips now building may afford more real information than either draughts or models.

Fourthly, As the conſtant variation of the curving line which forms a ſhip's body, cannot, I apprehend, be reduced to meaſure with any degree of certainty by the ableſt geometrician ſcientifically, it follows, to form any calculation therefrom, it muſt be ſought for in another manner; and, What way ſo eligible, and ſubject to leſs error, than the foregoing (the hydroſtatic mode excepted)? However, if

I am miſtaken, I bend with pleaſure to better judges; my only motive (as a bar ſeems in the way of effecting it in its proper manner) being a ſanguine deſire of aſcertaining a ſolution in the beſt poſſible way without it.

If I have failed in my attempt to explore a different path of ſolving the Queſtion propoſed, my endeavours, I hope, with all their imperfections, will be conſidered in a favourable light, as my only object in view was to bring it as near as poſſible to an immediate deciſion, for the ſatisfaction of the Public, being a ſubject ſo little underſtood, nay, I may venture to pronounce, never attempted before by any one; for which reaſon, I flatter myſelf, I have the greater plea to indulgence.

Having thus ſaid every thing that at preſent occurs by way of explanation and forwarding the deſign in abler hands, it remains, Mr. Printer, to make many apologies for the length of this epiſtle, and to intreat the favour of its inſertion in your Chronicle whenever convenient; in doing which you will greatly oblige, Sir,

Your moſt obedient,

Hampſhire, June 5th, 1792. P. E.

P.S. In anſwer to the Gentleman's Query *, viz. Suppoſe two veſſels, ſimilar, but built of different woods, whoſe ſpecific gravities are unequal—their admeaſurement is the ſame, though the columns of diſplaced water will be different both in a light and laden ſtate—Is their tonnage the ſame if their reſpective weights differ and draught of water alſo?—I ſay, their tonnage, which can be only aſcertained from their admeaſurement, is exactly the ſame; but their capability of carriage and draught of water different, in proportion as the difference of the ſpecific gravity of the materials they are built with. Further I ſay, being ſimilar in conſtruction, but of unequal weight, their difference of carriage may be reſtored by floating on different waters, as ſalt and freſh, in proportion as thoſe fluids bear to each other in ſpecific gravities. For argument's ſake, Suppoſe a ſhip built of the lighteſt wood, as fir, and another of the heavieſt metal, as gold (it matters not, the reaſonings are the ſame), their admeaſurement, which I call their tonnage, if on the ſame conſtruction, will be equal; but their capability of carriage and draught of water different, in proportion to the difference as fir is to gold; that is, the fir ſhip will have the advantage over the other in every reſpect except duration; but if navigated on different waters, as I ſaid before, as the fir ſhip on freſh, and the gold ſhip on ſalt, the inequality will be reſtored in proportion as the one bears to the other; but a very oppoſite effect, were they to change ſituations. There is, however, a fluid in nature, but ſeldom navigated on, that would place, perhaps, the metallic ſhip on an equality, in point of carriage, with the fir ſhip on freſh water, if not to as great advantage as the latter had over the former when floating on like waters.—— *Quære,* What is the leaſt poſſible quantity of water capable of floating a ſeventy-four gun ſhip? But I wiſh not this Query at preſent to interrupt an enquiry into the Queſtion before propoſed, as it is of more conſequence: this laſt is merely a curioſity.

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* See Page 141.

No. XII.

SPECIFICK GRAVITY OF SHIPS.

To the EDITOR.

SIR,

I BEG pardon for addreſſing you ſo ſoon again on the ſubject of the Specifick Gravity of Veſſels; but it has occurred to me ſince I wrote you* that the queſtion therein ſtated may, I believe, be freed from all its difficulties and embarraſſments on the following arguments and conſiderations.

Magnitude is a comparative idea, conſequently greatneſs or ſmallneſs are only relative terms, and equally applicable to the different ſizes of ſhips as other bodies; therefore, as every veſſel, whether great or ſmall, muſt be ſuppoſed to conſiſt of parts proportional to her bigneſs, it muſt be admitted, that if ſuch veſſels are of the ſame conſtruction and materials, they will be proportionally alike in all reſpects; that is, the tonnage and ſpecifick gravity of the leſs will be in the ſame proportion to each other, as the tonnage and ſpecifick gravity of the greater. On this doctrine of proportionals, or ground of reaſoning, to which, I conceive, no ſolid objection can be made, I recommend the following experiment for aſcertaining the ſpecifick weight of ſhips:

Provide a model of a ſhip of war, I mean a tolerable ſized one, four feet by the keel or thereabouts, the larger the better, for a very ſmall one will not ſo well anſwer the purpoſe; the model to be ſimilar alſo in all its parts within-board. Float the model in a ciſtern of ſalt water ſufficient for the purpoſe; but previous thereto, aſcertain the height of water in the ciſtern: after the model is floated or placed into it, notice again the height of the water—the difference, I think, it is evident, will be found to be equal to her ſpecifick weight:—that weight, whatever it may be, applied to her admeaſurement, which muſt be very nicely adjuſted, will produce ſome certain ratio or proportion to each other, that will eſtabliſh an unerring rule to go by in all future caſes of like nature.

The experiment being thus completed, I beg leave to ſubmit, Whether the proportion of the model's ſpecific weight to her admeaſurement, may not be applied with certain ſucceſs to larger veſſels, for aſcertaining their ſpecific gravities? For my own part I can ſee nothing to the contrary; and ſhould that opinion be received, the queſtion, I think, is ſolved without further trouble. I add, if I may be permitted to hazard an opinion, I ſhould conſider the weight of any ſhip to be ſomewhat near 3-8ths or 7-16ths of her tonnage, by admeaſurement—that is nearly one half.

Should I ever have an opportunity of fixing the true proportion by experiment, you will certainly hear from me again, if not given to the Public before by ſome more able perſon.

Your moſt humble ſervant,

Hampſhire, Aug. 18, 1792. P. E.

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* See Page 141.

No. XIII.

VINDICATION OF DR. FRANKLIN.

Extract from the MONTHLY REVIEW *of the* SECOND PART *of the* "COLLECTION of PAPERS on NAVAL ARCHITECTURE."

AFTER obſerving, that the materials of which this *Second Part* of the *Collection* is compoſed, "are not inferior to the contents of the former Number, in reſpect either of their variety or of their importance," the Reviewer proceeds:

"Among the variety of Papers of which this *Second Part* conſiſts, we obſerve an APPENDIX, containing ſeveral uſeful hints; but we were particularly ſtruck with a paſſage in No. VI. of theſe Naval Communications, in which is introduced an unjuſt reflection (as we conceive) on the character and conduct of a truly great man, who, being no longer an inhabitant of a world to which he was a diſtinguiſhed benefactor, cannot, therefore, vindicate himſelf. Thus circumſtanced, it becomes the duty of every generous friend to *Truth* (diſdaining all *party conſiderations*), to ſtand forth in defence of injured merit. The paſſage to which we allude is this: Speaking of a Monſ. de Landais, a French ſea-officer, who had made naval architecture his chief ſtudy, and who had ſerved in the late American war, it is ſaid, that accidentally mentioning in converſation the Conſtitution of the United States of America, "he greatly cenſured Dr. Franklin, as greedy of popular applauſe, for which he ſacrificed much, and even betrayed his truſt;" adding, "that he was a defaulter, in reſpect to money entruſted to him from the United States, and had evaded giving any account."

On this bold accuſation, we are enabled to offer a few remarks by the aſſiſtance of a gentleman, on whoſe *competency to the queſtion* we can with ſafety rely:

"Whether Dr. Franklin was, or was not greedy of popular applauſe, is a queſtion which may be beſt anſwered by thoſe who *knew him beſt*, and were moſt acquainted with the tranſactions of his life; of which number Capt. Landais certainly was *not* one: but that he "ſacrificed much, and even betrayed his truſt," to obtain it, will not be believed, nor ought it to have been aſſerted, without ſome inſtance and proof of ſuch ſacrifice and treachery; of which hitherto there is no appearance of probability.

"Concerning the allegation that Dr. Franklin 'was a defaulter in reſpect to money entruſted to him from the United States, and had evaded giving any account,' it certainly is a moſt groundleſs calumny; ſuch indeed as ought not to have been publiſhed againſt one of his long eſtabliſhed character, on the poor authority of Capt. Landais, who was notoriouſly actuated by unprovoked malevolence; and who, by being tried, and diſmiſſed the ſervice of the United States for a ſmall part of his miſconduct, eſcaped the conſequences of a much more ſerious charge.

" To repel this and all ſimilar calumnies againſt Dr. Franklin, it will be ſufficient to mention what is generally known, *viz.* that before he quitted Europe and the character with which he had been inveſted at the Court of France, he fully *ſettled* and *balanced* all his public accounts with Mr. Barclay, who was then Conſul General of the United States in that kingdom, and was, by a particular commiſſion from Congreſs, appointed and authoriſed to audit and ſettle the accounts of all thoſe who had been entruſted with the diſpoſal of money in Europe, for or on account of the ſaid States; that, after Dr. Franklin's return to America, he was unanimouſly choſen to the higheſt office of the State in which he reſided; that he was re-elected to that office, for the greateſt number of times which the Conſtitution allowed; and that at his death, beſide ſeveral important legacies of a public nature, he left a conſiderable eſtate within the juriſdiction, and ſubject to the claims of the United States; and as they have never made any claims on his property, that circumſtance will, doubtleſs, place Capt. Landais's calumny in its true light.

" Candour will oblige us to ſuppoſe, and we take it for granted, that the Editors of this Collection were not aware of the falſehood of a charge here brought againſt a perſon ſo highly eſteemed as Dr. Franklin juſtly was; and that the calumny of Monſ. Landais was inadvertently inſerted in a Collection relating to matters of a very different kind."

No. XIV.

To Mr. SEWELL.

DEAR SIR,

CONCEIVING it a duty incumbent on every man, as well for the benefit of his country as of ſociety at large, to advance whatever his abilities may ſuggeſt towards the improvement or perfection of any art or ſcience, let it be in ever ſo ſmall a degree, I am induced to propoſe, through the channel of the Wrapper of your uſeful Magazine (of which I have been an admirer ever ſince you firſt intimated the idea of the Improvement of Ship Building), a method of meaſuring the tonnage of veſſels of every ſize and denomination; which, though not an exact one, is much nearer than the common method; and I hope ſome more judicious perſon will make ſtill greater improvement. I think there needs no apology for my offering it, the preſent mode being univerſally held as erroneous, and particularly by the laudable Society lately eſtabliſhed for the Improvement of Naval Architecture, who have offered a Premium for the moſt accurate and conciſe method. To proceed therefore, I will preſent an example from two veſſels exactly the ſame length, breadth, and depth; but different in the bulk of their bodies, one of which is very ſharp, the other flat.

Fig. 1

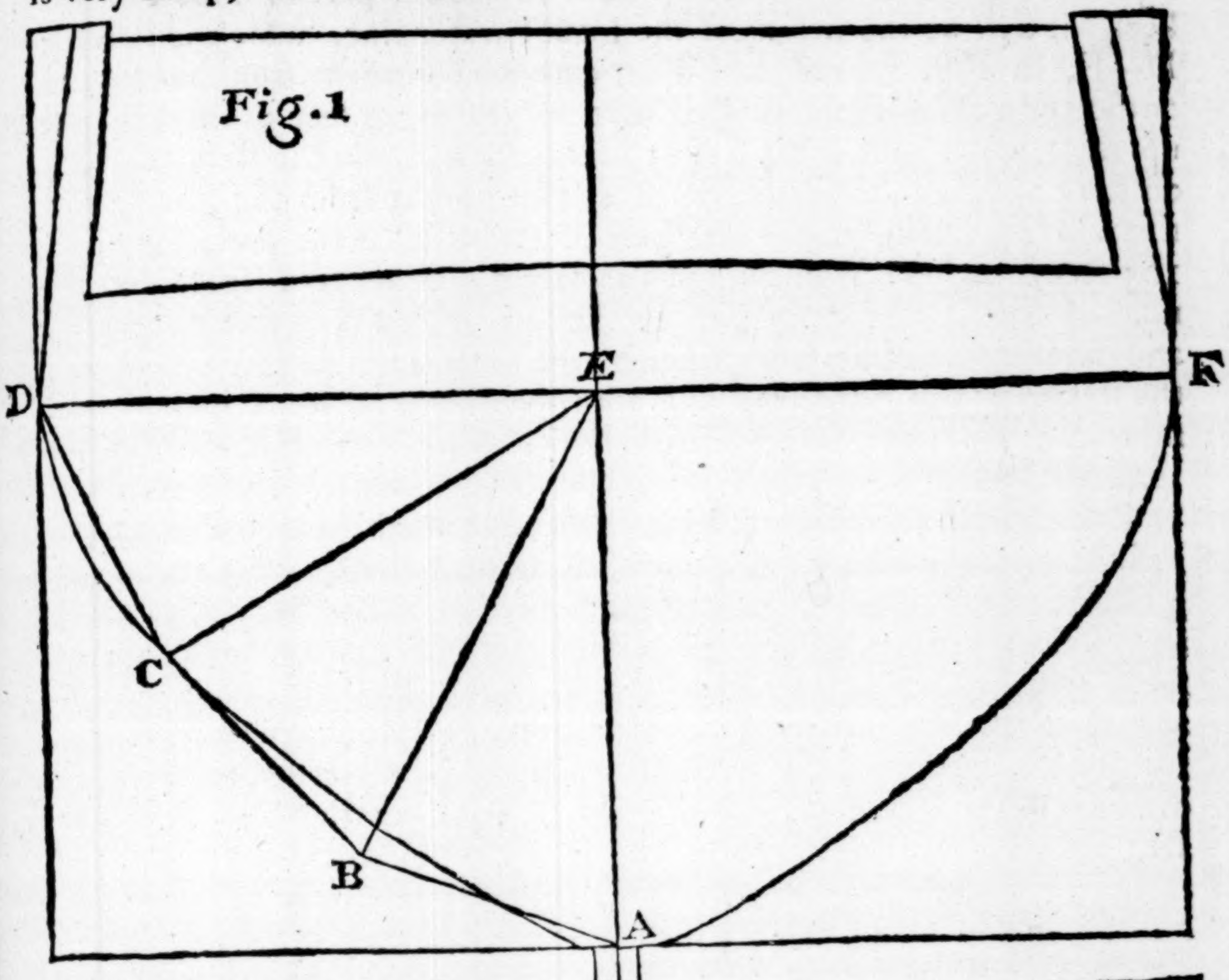
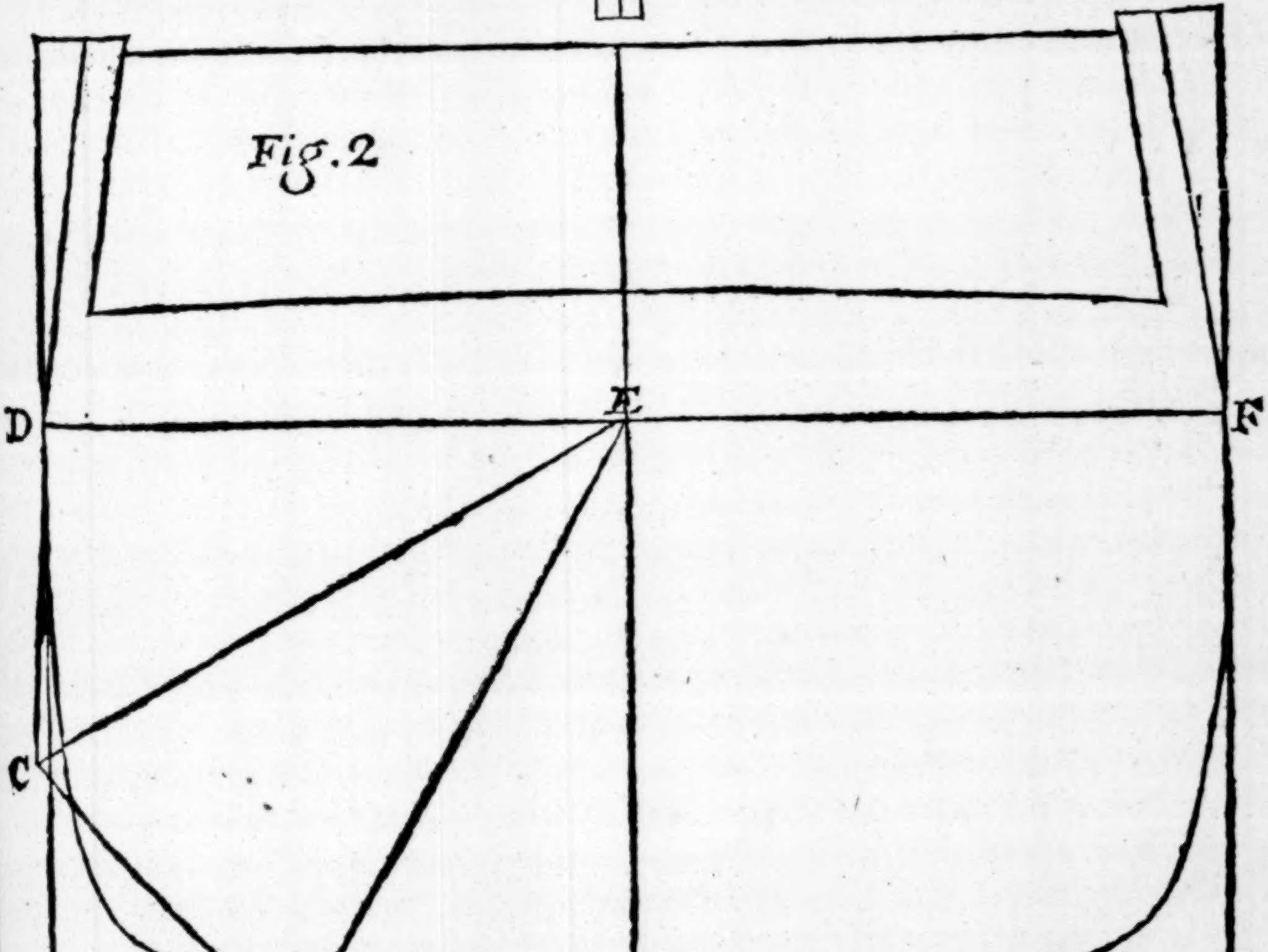


Fig. 2



Take the perpendicular height, from the lower part of the rabbit of keel to the upper part of the plankſheer (or gunnel), at the fore part of the main hatchway, which is 23 feet 2 inches; three-fifths of which is 13 feet 11 inches: which ſet up from the lower part of rabbit of the keel, it will be the height of the loaded water line, which is the line D—F, in Fig. 1, and 2. The extreme breadth from outſide to outſide of a three-inch plank at that height is 29 feet 5 inches; ſet up the ſame height of 13 feet 11 inches forward on the ſtem, and aft on ſtern poſt, and take the length at that height from the fore part of the rabbit on ſtem, to the aft part of rabbit on ſtern poſt, which is 105 feet 6 inches; from which ſubtract $2\frac{1}{2}$ inches to a foot, for the rake of ſtern poſt for 13 feet 11 inches, which is 2 feet 11 inches, and three-fifths of 29 feet 5 inches, the extreme breadth, for rake of the ſtem = 17 feet 7 inches; add both together = 20 feet 6 inches, and ſubtract it from 105 feet 6 inches, leaves for the length of keel for tonnage 85 feet.

Take the diſtance from the lower part of the rabbit of keel to 13 feet 11 inches on the curve of the body (or, from A to D), which is 21 feet 3 inches (ſee Fig. 1ſt); divide half the curve of the body into three angles thus: one-third of 21 feet 3 inches is = 7 feet 1 inch, which ſet your compaſſes to; and place one foot at A, the middle line of keel at garboard ſtrake, and ſweep a ſmall circle, B. Again, ſet one foot at D, and ſweep the circle at C. On theſe two circles ſet off the ſame diſtance 7 feet 1 inch parallel to AD.; then draw the lines CE and BE, which forms three angles: calculate the ſuperficial feet in each of them (by multiplying the baſe by half the perpendicular), = 47 yards 9 feet 9 inches — 44 yards 3 feet 3 inches, and 46 yards 6 inches; add them all together = 138 yards 1 foot 6 inches. Multiply this by 2 (it being only the ſuperficial feet of one half the ſection), which is 276 yards 3 feet (the ſuperficial contents of the midſhip bend of the veſſel to the height of the loaded water line); multiply 276 yards 3 feet by 85 feet the length of the keel, = 23481, and divide it by 64; which produceth $366\frac{57}{64}$ for the tons burthen of a veſſel of the deſcription of Fig. 1. which is a very ſharp one.

Again, let us proceed to Fig. 2, in ſame manner as Fig. 1. Diſtance from A and D, on the curve of the body, 26 feet; one-third of which is 8 feet 8 inches: ſet off three angles, the baſe 8 feet 8 inches each, the ſame as Fig. 1, and compute the ſuperficial feet, viz. 66 yards 5 feet 4 inches — 71 yards 6 feet and 64 yards 3 feet 4 inches; added together make 202 yards 2 feet 8 inches; multiplied by 2 is 404 yards 5 feet 4 inches; again by 85 the length of keel = 34373 yards, which divided by 64)34373($537\frac{5}{64}$ for the tons burthen of a veſſel of the deſcription of Fig. 2, which is a very flat one.

Theſe veſſels both meaſure by the eſtabliſhed method 402 tons; and it is an experienced fact that the one will not carry ſo much, and the other a great deal more.

I do not pretend to advance this as a perfectly exact method; but that it is much nearer the real burthen of veſſels than the old eſtabliſhed one: neither do I think there ever will be any method found out to meaſure all deſcriptions of veſſels by one common rule exactly, as the tonnage of veſſels depends in ſome degree on the weight and ſcantling of the wood they are built of. For inſtance, an Archangel veſſel built of

fir

ſir will carry conſiderably more than another, of the ſame plan in every reſpect, built at the Havannah of live oak. Again, ſome veſſels have a very fine body aft and forward; others very bulky. Suffice it therefore to ſay, that all the eſſential dimenſions, the length, breadth, depth, and bulk, are conſidered by this method as equal operators in computing the tonnage; and as to my certain knowledge there are many veſſels of the ſame length and breadth, ſome of which are two and three feet higher than others of the ſame meaſurement according to the eſtabliſhed method, by this would be conſiderably augmented; and with regard to veſſels of the ſame length, breadth, and depth, but of different bulk, the two Sections here delineated fully ſhew there muſt be a conſiderable difference in their burden; and that there is, there are few veſſels but what ſufficiently demonſtrate.

The method itſelf is very plain and obvious: nothing more is required to be done in dock, or on the ground, or wherever the veſſel is, but to take the length, breadth, the height of plankſheer, and the number of feet there are from the middle line of keel at the lower part of garboard ſtake to three-fifths of that height, traverſing round the bulk of the body; all the reſt may be done in ten minutes on paper, as before ſhewn.

If this only ſerves as a hint to ſome more accurate and conciſe method, I ſhall never conſider the time and pains I have been at in meaſuring many veſſels, and making various calculations, thrown away; but, on the contrary, think myſelf happy in being the humble means of advancing the ſmalleſt part on the ſcale of improvement, however far diſtant it may be from the end of perfection. I beg leave to ſubſcribe myſelf,

Dear Sir,
Your very humble Servant,
J. B.

Limehouſe,
May 14, 1792.

No. XV.

SLIDING KEELS.

A PARAGRAPH having appeared in the public papers, that Sliding Keels are a new invention, equal in importance to the diſcovery of the compaſs, I muſt beg leave to ſay, that this aſſertion is not true, for Sliding Keels never can or ought to be fixed to ſhips of any ſort, eſpecially ſhips of war, which are hardly ſtrong enough at preſent to bear the immenſe weight of metal, much leſs to be made weaker in the moſt eſſential part of them; nor would it be ſafe to have three large apertures lengthways in the keel of a ſhip, which beſides weakening muſt hurt her ſtowage. If the diſcovery of Sliding Keels is great, the Public are indebted for it to the Indians of South America, whoſe Balzas (ſee them deſcribed in Ulloa's Voyages, Vol. i. p. 181.) have theſe Sliding Keels; and from them the idea has been taken, which has been very ingeniouſly improved upon.

No.

No. XVI.

To Mr. SEWELL.

SIR,

AMONGST the Naval Communications that appeared on the Wrapper of your Magazine for laſt month, a Correſpondent aſſerted the impropriety of fixing Sliding Keels in *ſhips of any ſort*, alledging the apertures in the keel muſt weaken the frame, and the trunks or wells hurt the ſtowage.

The ſlighteſt inſpection will convince any one, that the latter objection has no weight; and let facts ſpeak for the former. The Cutter built by the Admiralty after 18 months conſtant cruizing in the Channel, was found, on a minute inſpection in Woolwich Dock Yard, to be perfectly free from any appearance of defect that could poſſibly ariſe from her being weakened or ſtrained by the Sliding Keels.

LIEUT. MALBON, R. N.

June 20th, 1792.

No. XVII.

To Mr. SEWELL.

SIR,

HAVING heard much of Capt. Schank's Sliding Keels, I begged my paſſage on board the Trial Cutter, and ſend you ſuch Obſervations as a landman is capable of making. The term does not convey to me an idea of the contrivance: *Engliſh Lee-boards* would not be much more adequate, and *Central Lee-boards* would be a contradiction in terms, though more fitting than any other to be found in the Dictionary. So I would recommend ſome Lexicographer, Diſciple of Dr. Johnſon, or others accuſtomed to coin words, to compoſe one on purpoſe for this contrivance, while I proceed to give the beſt deſcription of it I am able.

At 5 o'clock, July 3, 1792, P. M. weighed anchor oppoſite Graveſend, Wind W. S. W. moderate. At three quarters of an hour's flood, was long-ſide the Spaniard. The after-keel being down, croſſed that ſand; on touching it the keel roſe of itſelf about fourteen inches, and ſhe went over it ſo eaſily, that the people only felt an unuſual motion. Lieut. Malbon and the Pilot, who did this on purpoſe, had ſcarce informed us of the cauſe, before ſhe was completely over, and the keel fell down of itſelf to its former place with the ſame eaſe as it roſe. The Pilot, a ſenſible diſcreet man, ſays, this is the firſt time a ſhip of her burthen ever attempted to go over this dangerous ſand: I therefore refer the advantages that muſt appear to every ſeaman, of veſſels on this conſtruction above all others. We anchored in Margate-roads at ten o'clock the ſame night, viz. 5 hours from Graveſend with tide againſt us the greateſt part of the way. At one next morning got under way, wind W. S. W. good breeze, or rather what the ſailors term a freſh gale. Anchored in the Downs at ſix the ſame morning.

This Veſſel, called the Trial Cutter, built as far under the direction of Capt. Schank as our *Eſtabliſhments* will permit, is 121 tons burthen; pierced for 12 guns, mounts eight carriage and 4 ſwivels; 65 feet long, 21 feet 4 inches broad, her ſcantlings 10 inches; depth in the hold 7 feet 2 inches; moulded 20 feet 11 Inches; her keel *a bad piece of timber*. Theſe ſliding *keels*, as they are at preſent called, may with nearly the ſame propriety be called rudders, gaffs, booms, or any other term; they are compoſed of two planks of 14 feet long, 3 feet broad for the fore and aft, another the ſame length, 6 feet broad for midſhips, which ſlide by means of a winch through the decks, and a mortice through the keel, to the depth of ſeven feet below the real keel, at pleaſure; thus they act as lee-boards. Theſe mortices are made in form of wells, as in cod ſmacks, caulked and ſecured in the ſame manner, which has given riſe to the ſuſpicions of weakening the veſſel, and hindrance of ſtowage: theſe inconveniences may be avoided many ways; in this the wells are ſecured by carlings. The room taken up for them and their wells, not more than 6 inches before and aft the maſt, is leſs than the maſt and its ſtep by 4 inches, conſequently can be reckoned in no other light than a uſeful parting of cabins, as well as ſtanchions to the deck, and are found uſeful in navigating; and the helm is ſo eaſily managed, that the ſtrength of a child is ſufficient when the keels are uſed, while that of a man with the tiller-rope is ſcarce ſufficient without them; and, as I was informed by the Lieutenant and Maſter, ſhe could be ſteered, as was frequently done, by the keels only, and in caſe of the loſs of the rudder could be navigated to any port by means of this invention. She draws 6 feet water when light, and 6 feet 6 inches when all her guns and ſtores are in; other veſſels of her burthen draw 13 feet. This new invention, when down, extends 7 feet below her real keel, by which ſhe keeps her wind better than any other veſſel in the ſervice; can carry as much preſs of ſail as any veſſel, and is capable of ſtowing more than any ſharp-built veſſel: this is a valuable quality when applied to trade in particular. The pilot declared he never was in a ſtiffer or more governable veſſel, as ſhe performs her oſcillations in leſs ſpace than moſt others, little more room than her length being ſufficient to tack. Therefore, from what I have ſeen, and what I have heard, this is one of the greateſt improvements Ship-building has experienced for a long time. Much praiſe is due to the perſeverance of the inventor, who had all the obſtinacy of old prejudices to contend with; but his patrons, the Duke of Northumberland and Sir Charles Middleton, have great merit in aiding him through the arduous taſk. Had the latter continued in office, probably we might have had a ſloop and a frigate at ſea by this time, drafts and orders being prepared for that purpoſe, but change of men frequently renders good deſigns abortive. As I underſtand, a gentleman of ſhrewd obſervation, and more knowledge of the ſea, propoſed to go to Teignmouth in her; I hope he will favour the public with his obſervations.

No. XVIII

From the PUBLIC ADVERTISER *of July* 23, 1792.

SIR,

OF Education, Biſhops, Blackman-ſtreet, enough.—Let the laudable Society for the Improvement of Nautical Skill eſtabliſh a mode of proof which ſhall ſpeak to the capacities of the loweſt claſſes of uſeful ſeamen, as well as to the improved intellect of the higheſt.

The extent of a billiard table is field ſufficient for experiment, as to the reſiſting fluid where the mould of a veſſel is concerned—that of a tennis court to the influence of wind, loftineſs of maſts, ſpread of canvas, breadth of yards, draught of water, quota of ballaſt, diſtribution of ditto, power of wind on maſts, ſails, rigging (proportion obſerved)—Let a trial be made of canvas boiled in ſhavings, or ſaw-duſt of oak in the dock-yards, rolled cloſe, or expoſed to the weather for days, weeks, or months, the day noted, the event reported—I think it won't mildew (the experiment has been made with cedar).

Let the navy be furniſhed with ſo much more fat pork as a deduction of rancid butter will allow—fat reſiſts putrefaction, and is nutritious—lean meat is ſuſceptible of deleterious ſcorbutic properties.

Cotton-yarn makes log-lines which do not ſhrink, therefore proper to keep a ſhip's way with much accuracy—a point of importance, eſpecially on diſcoveries—Ventilators to the ſheet cable tier eſpecially—Ratios of vinegar and wine—a life is worth ſo much.

A choſen Nautical Library on board—ſay to the amount of 90l.—open to the whole crew.

Silver medals for ſkill, ſobriety, &c.

A hiſtory of every ſhip of war from her building—the obvious merits or defects of her conſtruction noted—the ſervice on which ſhe was employed—the eminent ſervices of private ſeamen certified by the Captain, Firſt Lieutenant, Maſter, Gunner, Carpenter, Boatſwain, &c. to be publiſhed, ſubject to correction—character of Chaplains—conduct of Surgeons—regimen obſerved—reſult.

I am aware, that the Navy-Board has looked to ſome of the above particulars; but a reviſal of loſt or ſtrayed ideas can do little harm—as to the expence of publication do you ſee to that.

So I ſay,

Yours, and obliged as above,

No. XIX.

INFALLIBLE METHOD TO DISTIL FRESH FROM SALT WATER.

The following very intereſting Experiments were made by CAPTAIN WILLIAMS *of the* Revenue Cutter, *in the Service of the* States of Maſſachuſetts, *and communicated by him to the* Boſton Marine Society.

MARCH 6, 1792. Put four quarts of ſalt water in a tin ſaucepan, in the ſtove in the cabin; in 55 minutes I got from it near two quarts good freſh water; one quart of water left in the ſauce-pan, the reſt was loſt. The machine made uſe of was a tin crane, with a barrel or cooler made to it of the ſame, containing about three quarts, with a hole in the top and bottom to put the cold water in; I let it out occaſionally as it heats; I found that the barrel was not large enough to keep the tube cold. I then put five gallons of ſalt water in an iron pot, made the pot-lid tight by putting ſome old canvas round it; made a hole in the middle with a hollow plug to receive the crane; I got from it two quarts of good freſh water in one hour and a half, but finding my cooler was not large enough to keep the crane cool, I left off for that time.

April 11. Put in an iron pot twenty-ſeven quarts ſalt water, and got from it of good freſh water, ---- 22 quarts.
Left in the pot, ---- 1 do.
Loſt in ſeven hours, ---- 4 do.

27

The Machine made uſe of here, is as follows: *viz.*

I took a hand pump, ſawed it angleways, and when put together, formed a crane; a gun barrel ran through a half barrel tub of water, with the end of it fixed to the crane; the pot-lid fixed with old canvas tacked round it, and made to fit very tight, and ſecured down to prevent its riſing, and ſhifted the water in the tub occaſionally as it grew warm; the cooler it is kept the better it will run.

April 21. Made a wooden tube to uſe in the room of the gun barrel through the tub of water. I put one quart of beans in the pot with twelve quarts of ſalt water, in about one hour I got from it one quart of freſh water; it taſted very little of the beans, but found that the wood did not anſwer ſo well as the gun barrel, it being ſo thick that the cold water had not power over it to keep it cool.

April 23. I caſt a leaden tube, and put it through the tub, put in the pot twenty quarts of ſalt water; got from it in four hours nine quarts of good freſh water. The pot was dry, and about a pint of the laſt running had a diſagreeable taſte. I took out of the pot a pint of dry ſalt. I found the lead was ſo thick that I could not keep it cool, which was the occaſion of my not getting more freſh water, as it went off in ſteam. I believe, if the lead was made very thin it would anſwer very well.

April 24. Put in the pot eleven or twelve pounds of ſalt beef, and ſixteen quarts of ſalt water, and in one hour and a quarter I got five quarts of good freſh water; it had a little taſte of the beef, and a very ſmall appearance of greaſe on the top, which by filtering through a linen cloth, took it all off. With the above, I made uſe of the gun barrel, and find that in cooling any thing at ſea, a conſiderable quantity of freſh water may be ſaved, without expending any more wood than would anſwer to boil the meat, by having a hole through the pot-lid with a plug to it, to ſupply the water in the pot occaſionally as it boils away. With the iron tea-kettle that holds when full five quarts, I put in it four quarts ſalt water, fixed a wooden lid that was tight, made a hole through it to receive the crane, ſtopt the noſe, and with my tin crane at the cabin ſtove, I got from it in one hour and a half five pints of good freſh water, and near three pints of water left in the kettle.

JOHN FOSTER WILLIAMS.

No. XX.

PLAN *for Providing the* NAVY *with an Immediate, a Complete, and a Perpetual Supply of* SHIP TIMBER, *equal to its greateſt known Conſumption, by Means of the* ROYAL FORESTS *and* CHACES.

By *MAJOR CARTWRIGHT.*

1. SURVEY all Foreſts, Chaces, and other waſte lands of the Crown or the public, and delineate them on maps.

2. Satisfy all legal claimants, by giving them land equivalent to their reſpective claims *.

3. Then value all the land that remains, diſtinguiſhing it accordingly upon the maps.

4. Let the Commiſſioners who value proceed upon the ſuppoſition that the land is already divided by ſufficient fences into plots of fifty acres each, and lies within convenient diſtances of the dwellings of its occupiers; that it is alſo to be free from the preſent land-tax, and from tithes of any kind.

5. Divide it into lots, valued at 2,000l. per annum.

6. Where there may be oak-timber growing, let the ſame alſo be valued accurately.

7. Put each lot valued as above (making allowances for the timber thereupon) at 2,000 l. per annum, into the poſſeſſion of a private perſon by a grant from the Crown, to him and his heirs ſpecial for ever, with expreſs proviſions for keeping it for ever indiviſible. Let the grantee be Lord of the Manor, and hold his grant upon the ſole condition of paying a quit rent in ſhip timber and plank, of the yearly value of 1,000 l.; having at all times power of conveying or bequeathing his ſaid grant to any ſubject of Great Britain †.

8. The ſaid timber and plank to be delivered yearly, on or before a certain day, into ſome one Royal Dock Yard, to be named in the grant.

9. The quantity of ſuch timber and plank to be ſo delivered for 1000l. to be aſcertained by five Commiſſioners, according to what in their judgment it might be delivered at, upon an average, for ten ſucceſſive years from the date of the grant. The Commiſſioners to have no connection or contract with Government, nor any intereſt directly or indirectly with reſpect to the grants.

10. The Navy Board to ſet forth a table, containing every diſtinct claſs of oak timber and plank uſed in the dock yards, and the Commiſſioners to make their calculations upon each of the diſtinct claſſes ſeparately. This table of claſſes and value to be recited at large in every grant.

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* Unleſs, upon the whole, there may be a deficiency of land for the purpoſes of the plan. In that caſe it may be more expedient to give an equivalent in money.

† If upon calculating the expences of incloſing, clearing, draining, building, &c. theſe terms ſhall be thought too beneficial to the grantee, he may be made to pay for his grant ſuch a premium as ſhall leave him only ſo much emolument as may induce him to embrace the conditions of its tenure.

11. The Navy Board alſo to eſtimate the proportion of each of the ſaid claſſes of timber and plank which each dock yard would require; as alſo the proportion due from each grantee, ſo that all the grantees may be required to deliver equal quotas of every claſs, and none other, except with their own conſent; or except as hereafter is excepted. The table of proportions to be alſo recited at large in every grant.

12. But if the public ſervice ſhould at any time require an alteration in this mode of delivery, the ſame to be certified to the Admiralty by the Navy Board, and orders to the grantees to be by the Admiralty thereupon given accordingly; allowing, however, three years notice to the grantee, and informing him from which of the other claſſes he is to deduct timber or plank equivalent in value to that which is newly demanded of him.

13. Each grantee to have a right to deliver in more than his proper annual ſupply within any year, ſo far as to the amount of 250 l. and to have credit for the ſame; which credit ſhall ſerve inſtead of a future delivery of timber or plank of the ſame claſſes, but no other.

14. When timber or plank carried by land ſhall arrive at the dock yard, report to be made at the office of the ſtore-keeper *; and the ſaid timber or plank to be unloaded in whatever part of the yard the ſaid Store-keeper, or, in caſe of his abſence, the next in authority in his office, ſhall appoint.

15. But with regard to timber or plank carried by water, the delivery, ſo far as may relate to the forfeiture of the grant, to be eſteemed duly performed, ſo ſoon as the ſame ſhall arrive in the harbour where the dock ſhall be ſituated, or, if on a river, within half a mile of the dock yard. Report to be made as above, and the timber and plank brought to ſuch place or ſucceſſive places within the bounds of the ſaid yard, as the ſaid Store-keeper ſhall direct; and the full delivery thereof ſhall be eſteemed to be completed as ſoon as it ſhall be put into the boats, veſſels, ſlings, faſts or ſecurities of His Majeſty, or laid on any wharf, or landing-place of the dock yard.

16. If any Store-keeper, or other perſon employed in the dock yard, ſhall unneceſſarily detain or impede the ſervants of the grantee in the delivery of any timber or plank, the party aggrieved to recover of the Store-keeper treble damages and treble coſts of ſuit, provided the proſecution be commenced within one year. Every ſuch cauſe to be firſt tried by a ſpecial jury of the county. If the Store-keeper himſelf be abſent from duty with leave of the Admiralty, then the perſon next in authority under him to be anſwerable as above. And if ſuch perſon, or ſuch Store-keeper, ſhall not be the actual offender, he ſhall nevertheleſs be the ſole perſon anſwerable to the grantee or his ſervants, for whatever delay or impediment may be wilfully given at the dock yard to the receipt, admeaſurement, or depoſiting the timber or plank, or in giving certificates of the delivery into his Majeſty's ſtores; having at the ſame time his remedy at law againſt the actual offender or offenders. And for every offence of this kind, as well as for every fraud,

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* The maſter ſhipwright had been alſo mentioned in this clauſe, but it ſeems better that a grantee ſhould have no dependence on any but the ſtore-keeper.

fraud, in claſſing the timber to the prejudice of the grantee, in the ſum of 50l. and upwards, the actual offender to forfeit his office or employment, and be incapable of ever holding any other beneficial employment under the Crown ; the Store-keeper or perſon next in authority under him as aforeſaid, ſtill being the only perſon anſwerable to the grantee in this behalf.

17. If any officer or other perſon employed in a dock yard ſhall extort, demand, aſk, or receive from any grantee, his agent or ſervant, any bribe, fee, gratuity, or preſent whatſoever, directly or indirectly, on account or pretence of expedition, ſervice or favour, in reſpect to the delivery or receipt of any timber or plank, his office or employment to be forfeited, and the diſqualification abovementioned to take place.

18. Provided the ſtore-keeper or maſter ſhipwright ſee occaſion to object to any timber or plank of a grantee, a ſurvey to be had upon oath by three indifferent perſons ; and the opinion of the majority of them to determine the quality of the ſame. If unſound, it ſhall nevertheleſs be detained by the Store-keeper, meaſured, and entered in his books, to be applied to ordinary uſes ; but no receipt ſhall be given for it ; and at or before the time appointed for completing the next annual delivery, the grantee to deliver in an equal quantity of ſound timber in lieu thereof, over and above his regular ſupply

19. All the preſent foreſt laws to be repealed, and the granted lands to be made unalienable by any means whatever, except by forfeiture for non-performance of conditions, or elſe by ſale or transfer of the grant, with all its obligations entire and undivided ; which ſale or transfer to be made to only one perſon, and not to any partnerſhip or joint ſharers whatever. The perſon to whom ſuch grant ſhall be ſold or transferred to give notice thereof to the Treaſury and Admiralty Boards within one month, on pain of forfeiting the ſum of ——.

20. For the firſt four years, a failure to deliver in the requiſite quantity of timber and plank as it becomes due not to be a cauſe of forfeiture, provided that, in each of the ſaid four years, at leaſt one half ſhall be duly delivered in, and the whole before the expiration of the ſaid four years. For the next three years, the like indulgence, in caſe two thirds ſhall be regularly delivered, and the whole before the expiration of the term ; and for the next two years, the like indulgence, provided three-fourth parts be regularly delivered, &c.

21. After the expiration of all thoſe terms, making in the whole nine years, a failure to deliver in one-twentieth part of the annual quit rent of timber or plank in any year, to be forever after good and ſufficient cauſe of forfeiture.

22. And provided there be in any one future year a deficiency in the delivery, amounting to leſs than one-twentieth part, the grantee to deliver in, inſtead thereof, double the quantity before the expiration of the next ſucceſſive year. And if any grantee thus run in debt ſmall quantities from year to year (the ſame continuing to double every year) until his whole debt accumulate to one twentieth part of his annual quit rent, his grant to be thereby forfeited. And the rule for eſtimating ſuch deficiencies to be by admeaſurement and value ; agreeable to the original table recited as beforementioned in the grant.

23. But upon proof that the timber or plank of any grantee was ſhipped or loaded in proper time, and that its regular delivery had been prevented by unforeſeen accidents, of a nature to afford a reaſonable cauſe of juſtification, ſuch as contrary winds, ſhipwreck, roads ſuddenly rendered impaſſable, and the like, then the forfeiture of the grant not to take place, provided diligence be uſed in replacing every deficiency, and no appearance of intentional neglect or delay is diſcoverable to a Jury.

24. In every caſe of a forfeiture of a grant, the whole of the dwellings, buildings, and erections of every kind, and all fences, fixtures, or improvements, and all timber whether filled or growing thereupon, and belonging to the grantee at the commencement of the proſecution to be forfeited alſo; but not the ſtock, cattle, hay, corn, furniture, or moveables, nor growing crops belonging to any tenant or tenants, then occupying the whole or any part of the grant.

25. It is not to be lawful for His Majeſty or his ſucceſſors, or for any Miniſter or ſervant of the Crown, to excuſe any grantee from duly performing the condition of his grant; but on the contrary, it ſhall be the duty of the Comptroller of the Navy to proſecute for every failure in the due delivery of the timber or plank, on pain of loſing his office for any omiſſion therein. If nevertheleſs he ſhall neglect for one year to commence his proſecution, it ſhall then be lawful for any ſubject of Great Britain to proſecute in his or her own name; and upon proof of the failure on the part of the grantee, the grant to be forfeited to ſuch proſecutor, and his heirs for ever, to be held by him or them on the ſame conditions as thoſe on which it was held by the original grantee. The Record from the Court in which the cauſe was tried, to be to him and his ſaid heirs a good and ſufficient title to the grant.

26. In caſe of a forfeiture to the Crown, or of a lapſe to the Crown in default of heirs, every grant ſo forfeited or ſo lapſing, to be again granted to ſome other perſon under the Sign Manual of His Majeſty; but without any power of altering the original conditions. And if His Majeſty ſhould not within the ſpace of forty days make ſuch freſh grant, then any ſubject of Great Britain who ſhould firſt demand to be put in poſſeſſion of ſuch vacant grant, to be to all intents and purpoſes the legal grantee. This demand to be made in writing of the Lords Commiſſioners of His Majeſty's Treaſury, who thereupon ſhall immediately certify under their hands and the ſeal of their office, that, in conſequence of the ſaid demand, the demandant is become legal grantee of the grant in queſtion. Refuſing to grant ſuch certificate, the Lord High Treaſurer to forfeit 10,000 l. or the firſt Lord Commiſſioner 3000l. and each inferior Commiſſioner 1000l. each.

27. From the day on which there ſhall ceaſe to be a legal grantee in poſſeſſion of any grant, until it ſhall legally veſt in a new grantee, the tenants to pay their rents into the hands of a receiver to be appointed by the Court of Chancery, in truſt for the perſon who ſhall firſt become the legal grantee; and upon ſuch change, no new grantee to have a power of raiſing the rents for three years from the time of his obtaining poſſeſſion.

28. Every new grantee being thus ſecure of the profits of the grant from the commencement of the vacancy, he ſhall alſo be ſubject from the ſame period to the payment of the annual quit rent of timber and plank, being allowed only the ſame time for paying all arrears of timber or plank, as thoſe arrears have been in contracting before he got poſſeſſion.

29. If, notwithſtanding the intention of keeping every grant undivided, any grantee ſhall, by will or other inſtrument, attempt to divide the grant he holds amongſt two or more perſons, it ſhall nevertheleſs go to one of thoſe perſons only; either to be ſettled by agreement amongſt themſelves, or by drawing of lots before the Judge of Aſſize in the County Court, and each party concerned to have equal lot, notwithſtanding the grantee ſhould have intended to have made an unequal diviſion. If any one of them be a minor, or abſent, or ſhall refuſe to draw lots, the Judge to appoint ſome perſon to draw the lot of ſuch party. And in caſes of inheritance where there is no will or deviſe of the grant on the part of a deceaſed grantee, females ſhall inherit by ſucceſſion, and, by primogeniture, next after males, and not as co-heireſſes.

30. For the firſt fourteen years each grantee to be allowed to deliver in foreign timber and plank only.

For the next ſeven years,	6-8ths of foreign.
For the next ſeven	5-8ths ditto.
For the next ſeven	4-8ths ditto.
For the next ſeven	3-8ths ditto.
For the next ſeven	2-8ths ditto.
For the next ſeven	1-8th ditto.

And after the expiration of all the ſaid terms, or the full term of fifty-ſix years, none but Britiſh timber or plank to be delivered in for ever.

31. Treſpaſſers in woods or nurſeries of young oak liable to damage, to pay ten-fold damages, and treble coſts of ſuit; for wilfully breaking open any gate or fence thereof, a fine of 10 l. beſides damages and coſts as above; if the breach be more than one yard wide, to pay 20l. &c.; if more than two, 30 l. &c.; and ſo in proportion.

The Navy Board's eſtimate of the timber of all denominations required for one year's conſumption in all the dock yards is,

22,000 loads at 4l. 5s.	£.93,500
And plank 3,792	24,500
	£.118,000

The foreſts and chaces in England only, are taken to contain 316,000 acres, at 15s. per acre, £.237,000.

Beſides which, there are in Scotland the following foreſts, viz.

Falkland,
Scoon,
Lochmaben,
Linlithgow,
Dunſtaffnage,
Carirk.

But without theſe, thoſe before enumerated, if as extenſive as there ſet down, and the land be not over-rated, would be ſufficient for 118 grants and a half, producing timber to the amount of £.118,500 per ann. which exceeds the demands of all the dock yards by 500 l. per ann. As Mr. J. Pitt, Surveyor of the King's Woods, reported to the Houſe of Commons in 1771, that the major part of the foreſts was fit for the growth of timber; it is conſequently fit for the beſt purpoſes of agriculture, and therefore is ſcarcely valued equal to its worth at 15 s. per acre *. And as Mr. J. Pitt conceived, that by cultivating the ſaid foreſts, an income much beyond what is here reckoned upon might be obtained from them, the above eſtimates in reſpect to the quantity of land, are probably within compaſs. But ſhould the land remaining to the public after ſatisfying all claimants be ever ſo little, that little had beſt be diſpoſed of before it become leſs by the continuance of encroachments; and the Plan now offered is equally adapted to the purpoſe, whether the land to be applied for ſecuring us navy-timber be five thouſand acres, or five hundred thouſand.

As to the other benefits that would accrue to the nation from the cultivation of ſo many foreſts, beſides keeping our money at home, and becoming independent of foreign nations for timber to build our ſhips with, they are for the moſt part too obvious to need enumeration, and too many as well as of too great political magnitude to be diſregarded: But it ought particularly to be noted;

1ſt. That timber for the whole Navy would be annually delivered where it is to be worked up, without any future trouble or expence to Government.

2dly. The influence of the Crown, through all the places, emoluments, and jobs in or relating to the foreſts, would be annihilated; at the ſame time that the profits to the public would amount to upwards of 120,000 l. per ann. at low calculations.

The Civil Liſt eſtabliſhment would be eaſed of ſalaries to a large amount; while all perſons diſmiſſed might be better provided for in the diſtribution of the grants, or out of the premiums to be received by Government.

A future want of ſhip-timber would be effectually prevented, without any law to enforce its growth; and a neceſſary and important effect of the plan would be, to cauſe our timber to grow preciſely where it ought to grow, in the vicinity of the dock yards, or contiguous to navigation.

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* Free from tithes and land-tax, it may reaſonably be preſumed they would be worth one fourth more.

No. XXI.

To Mr. SEWELL.

SIR, *Copenhagen, Sept.* 10, 1792.

I RECEIVED the favour of your letter, with the papers relating to the Society, after having laid a long time by the way, juſt before I left Saxony; and I have been ſince continually travelling, that I have not before had time to thank you for them. Your Magazine is a very excellent one, and I deſire you to continue to ſend it me.

In regard to the experiments which I ſubmitted to the conſideration of the Society, which you wiſh to publiſh in your Magazine, you have my free permiſſion to do ſo. The Society has my hearty good wiſhes for ſucceſs in an object which is extremely wanting, to the diſgrace of thoſe who have the means, and whoſe duty it was long ago to have furniſhed the Science of Naval Architecture with the experiments neceſſary to lay a foundation for the firſt principles of an art in which half the world are intereſted, and which, extraordinary as it may appear, ſeems to me to be yet in a ſtate very diſtant from perfection. I have ſeen with pleaſure that the Society have ordered the execution of experiments on the reſiſtance of fluids, which I hope will, if they are not already, be executed with the accuracy and care ſo neceſſary. You will much oblige me in ſending me a copy of what has been done, with a drawing of the ſolids, and the reſult of the experiment made. But theſe, when executed, are but a ſmall part of what is abſolutely neceſſary; for experiments in midſhip frames (ſomething in the way of what I ſent you) are equally neceſſary; for of what uſe would the ſolid of leaſt reſiſtance be, unleſs it is united with the form moſt proper to carry ſail?—You mention in your Magazine a flat-bottomed veſſel with ſliding keels; I wiſh to receive a ſketch of it, if to be had. I ſend you incloſed a Propoſal for the Improvement of Veſſels already built, if you think it worth putting into your Magazine; it has been tried with ſucceſs.

There are many other experiments abſolutely neceſſary to be tried, of which I hope the Society will think; ſuch as length, breadth, depth, ſo as to aſcertain the advantage or otherwiſe of different dimenſions, and each relative to their power of carrying ſail; for otherwiſe more may be loſt on one ſide than would be gained on the other. There is, in my opinion, no other means to anſwer this invaluable object of the Society's inſtitution, but by experiments executed under their own eyes, with the greateſt care and judgment, to lay the foundation of the firſt principles; ſince mathematical calculation, however exact in itſelf, has been found unequal to the taſk, the nature of fluids remaining yet not ſufficiently known.

C. G.

No. XXII.

HINTS TO MARINERS.

A new and eaſy Method of preſerving Water ſweet in Sea Voyages, and of purifying it when ſtinking.

IT is well known that water cannot become putrid unleſs it contain animal and vegetable ſubſtances; and as this is the caſe with all river water, it follows, that this water, which is generally uſed on board of ſhips, is ſubject to become putrid and nauſeous, more or leſs in proportion to the quantity or quality of the animal and vegetable matter contained in it.

Another cauſe of corruption is owing to the diſſolving property of water; ſo that it often happens, that though the caſks be filled with pure ſpring water, yet the water, by diſſolving the impurities which may be found adhering to the caſks, and becoming impregnated with them, or even with the ſubſtance of the wood, will become putrid after a certain time.

The principal article, by the means of which Mr. Lowitz preſerves and purifies water, is charcoal duſt; and from a great variety of experiments the following particulars are deduced for the practical accompliſhment of an object ſo very important to ſeafaring people.

The charcoal muſt be pounded very fine, and the powder muſt be kept clean and as free as poſſible from duſt, ſmoke, or other impurities; but the quality of the wood of which the charcoal is made needs not to be regarded, provided it be well charred. Mr. Lowitz finds that even foſſil coal, when well charred and powdered, will anſwer the purpoſe; but he does not mean to recommend the uſe of it, on account of the metallic minerals which are frequently mixed with it, beſides other reaſons.

About three drams of charcoal duſt will preſerve four ounces of common river-water, or will purify it when actually ſtinking; but if a little acid be added, then a much ſmaller quantity of charcoal will do.

Any of the mineral acids will produce the effect, and even ſome ſalts; but the vitriolic acid is to be preferred, principally on account of its having no ſmell.

In order to preſerve freſh water, the caſks muſt be previouſly well waſhed and ſcoured with ſand or charcoal duſt. After having been filled with river water, put as much vitriolic acid into it as is juſt ſufficient to render the water ſlightly acid; then add about eight pounds weight of charcoal duſt to each caſk; and as the charcoal duſt naturally falls to the bottom of the caſks, it ſhould be ſtirred with a ſtick at leaſt once a day, ſo as to let it come into contact with as much water as poſſible; and this is all that needs to be done to prevent the water acquiring any bad ſmell or taſte.

When the water is to be uſed, it ſhould be filtered through a flannel bag, which muſt be had ready at hand, and a proper ſtand for it may be eaſily contrived. This filtration ſerves only to ſeparate thoſe finer particles of the charcoal which, by ſwimming in the water, give it a blackiſh appearance.

It is very remarkable, that if water be rendered juſt ſenſibly acid by mixing a little vitriolic acid with it, the addition of charcoal duſt will remove the acidity.

In order to purify the water which is actually ſtinking in the caſks, proceed in the ſame manner as in the preceding operations, viz. firſt, put ſome vitriolic acid into the caſk, and then as much charcoal duſt as upon trial will be found ſufficient to remove the bad ſmell. In caſe that neither vitriolic nor any other acid can be had, then charcoal duſt alone is ſufficient to purify the water; but in this caſe a greater quantity of it muſt be uſed; perhaps three times as much as when the acid is employed. This putrified water muſt be alſo filtrated as above.

In this manner the operation is ſoon performed; ten minutes, or a quarter of an hour, being more than ſufficient time for it.

To preſerve the water which has been thus purified when it is not immediately uſed, it muſt be removed into clean caſks; otherwiſe it is apt to become putrid again in a ſhort time.

It is almoſt needleſs to remark, that as the waters of different rivers, in different climates and ſeaſons of the year, are impregnated with various proportions of animal and vegetable matter, ſo the quantity of charcoal duſt which muſt be employed to preſerve and purify them muſt be more or leſs in proportion.

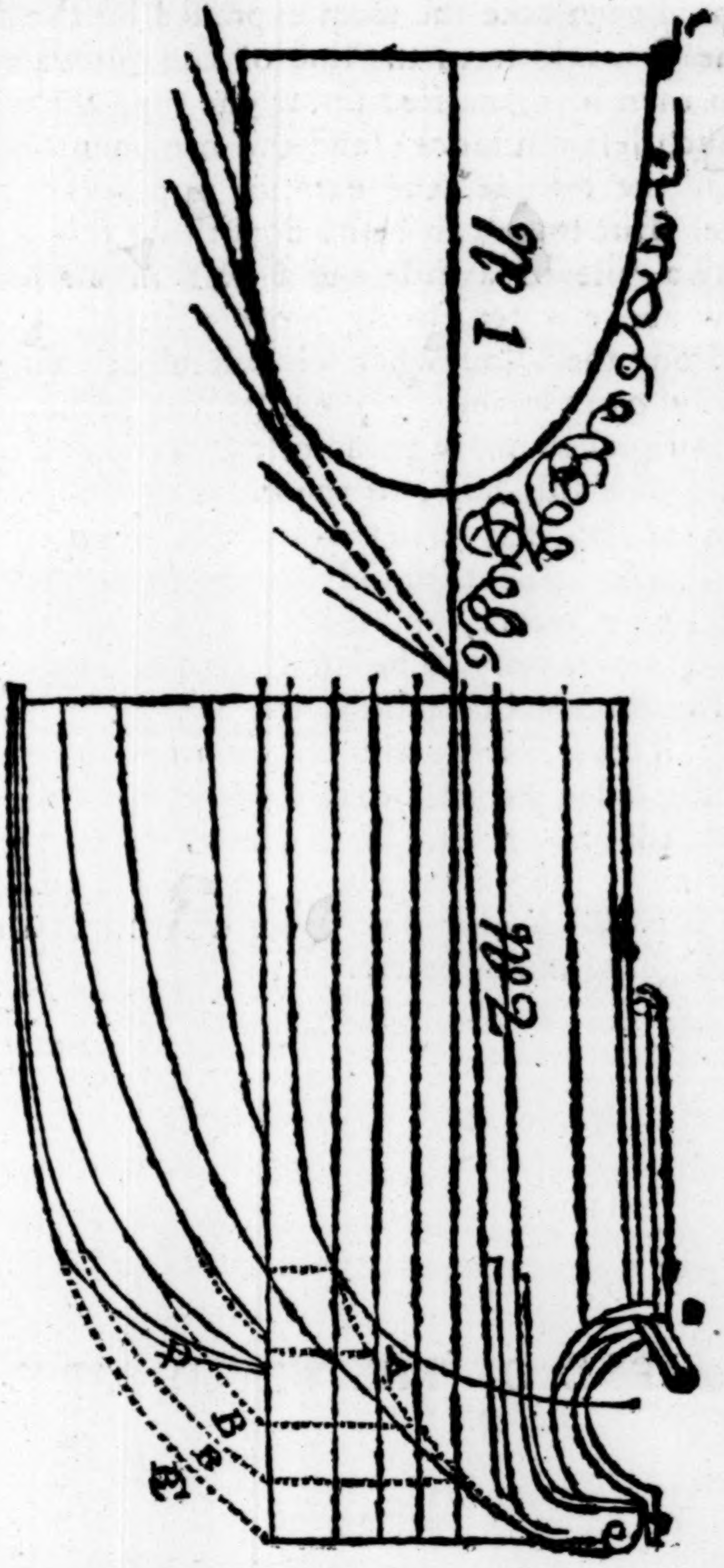
No. XXIII.

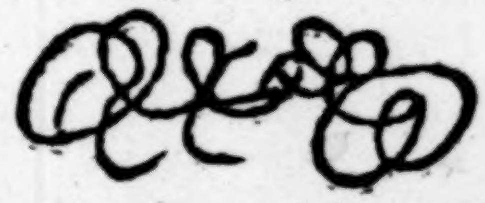
Upon the MEANS *of conſiderably increaſing the* VELOCITY *of* VESSELS *already built.*

FROM a variety of experiments tried, and the evident and acknowledged advantage which veſſels built ſharp forward enjoy, it cannot be doubted, that ſhips in general are formed with water-lines as well as a bow much too obtuſe, which occaſions them, inſtead of opening the fluid with eaſe, to meet with great obſtruction, driving before them an accumulation of water which plainly obſtructs their velocity, as muſt be obvious to any one who conſiders the water raiſed by a ſhip under ſail.

In ſhips which have a cutwater and ornamental head projecting forward from the ſtern, this accumulation is greatly encreaſed to leeward when ſailing upon a wind. There is then an angle formed by the round bow and the cutwater, within which are confined many tons of dead water, which remain a dead weight and obſtacle to the progreſſive motion, and which may obſtruct near or quite as much as the topſail does ſervice. This can ſcarce have eſcaped the obſervation of whoever has ſeen a ſhip cloſe hauled under way; and they muſt have obſerved the white and broken water, particularly to leeward, occaſioned by this confinement and obſtruction. The remedy is eaſy and of little expence, and ſurely worth trying, ſince I believe it may make the difference of a mile or a mile and a half an hour.

Suppoſe the water-lines in the following diagrams, which are taken from thoſe of a 90 gun ſhip, viz.



No. 1. is a repreſentation of the water-line and cutwater; one ſide of which is boarded up, and along which the water paſſes obliquely ////, and with little difficulty; the other ſide repreſents the angle formed by the roundneſs of the bow and the cutwater; in which angle (particularly when going to windward) the water is confined, as is expreſſed by  or dead water, of which there remains, particularly to leeward, many tons in a large ſhip, and conſequently a conſiderable obſtruction.

No. 2. re-

No. 2. repreſents the water-lines of a 90 gun ſhip, which being very obtuſe muſt occaſion great reſiſtance. The alteration propoſed by boarding up according to the dotted line A, would render thoſe lines infinitely more proper for dividing the fluid; and thoſe water-lines would then take the form expreſſed by the dotted lines B. The dotted line C would form the line of the gunwale inſtead of D. This alteration then being carried up to the top, the whole will form a cone with much leſs reſiſtance; and the ornamental head and rails being added on the outſide, the exterior appearance will be pretty much as before. But there can be no doubt that this alteration would gain in velocity a mile to a mile and a half in an hour. Even the part of the bow above water, being more pointed, would meet with leſs reſiſtance from the wind when cloſe hauled, when a round bow aloft is certainly conſiderably affected by the wind only, and may be conſidered as equal to many yards of canvas ſpread in the ſails.

The partiſans of a full bow, as the uſual expreſſion is, to keep the veſſel up in a head ſea, may perhaps ſay, that ſhe will bury her bow, being become ſharp. But it ſhould be conſidered that the veſſel has the ſame capacity as before, and more by this addition, which contains no weight, and is only to be conſidered as a cone added forward for dividing the fluid with facility, the weight of the foremaſt remaining where it was before, and ſtill better ſupported by this additional capacity added in the beak, as is evident in the Plan.

A celebrated Admiral in the Dutch ſervice aſſured me, that he had tried this experiment upon a frigate in the Weſt Indies, and that he had ſucceeded perfectly well; the frigate which had a round bow and full water-lines going much better.

C. G.

END OF THE THIRD PART.

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